Cherryvalleyrostrum, a new late Eifelian rhynchonellid (brachiopod) genus from North America

by Paul SARTENAER

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Abstract

A new genus, *Cherryvalleyrostrum*, type species *C. limitare* (VANUXEM, 1842), is described from the late Eifelian of New York State; its presence in Maryland, New Jersey, Ohio, Virginia, and West Virginia, and in the Province of Ontario, Canada, is highly probable. The genus is compared to the Middle to late Givetian genus *Platyglossariorhynchus* SARTENAER, 1970, type species *P. proteus* (TORLEY, 1934), whose internal characters are more fully described than before.

Key-words: Camarotoechiidae, *Cherryvalleyrostrum*, rhynchonellids, brachiopods, Late Eifelian, North America.

Résumé

L'auteur fonde un nouveau genre, *Cherryvalleyrostrum*, avec *C. limitare* (VANUXEM, 1842) de l'Eifelien supérieur de l'État du New-York comme espèce-type; sa présence dans les États du Maryland, du New-Jersey, de l'Ohio, de la Virginie, de la Virginie de l'Ouest et dans la Province de l'Ontario au Canada, est hautement probable. Le genre est comparé à *Platyglossariorhynchus* SARTENAER, 1970 du Givetien moyen et supérieur, dont les caractères internes de l'espèce-type, *P. proteus* (TORLEY, 1934) sont décrits plus complètement que jusqu'à présent.

Mots-clefs: Camarotoechiidae, *Cherryvalleyrostrum*, Rhynchonellides, Brachiopodes, Eifelien supérieur, Amérique du Nord.

Introduction

Expressions such as *Leiorhynchus* zone [fauna, subfauna, community, assemblage, association, phase, horizon, (bio) facies, bed(s), bearing beds (shales), layers (Schichten)] are commonly used in the literature, particularly in the Middle and Upper Devonian of New York State, where the genus was established and consequently, of China, due to GRABAU's influence.

In the Cayuga Lake section of central New York CLELAND (1903, pp. 20, 22-23, 25, 30-31, 42, 45, 90, table, pp. 95-104 = appendix) recognized four *Leiorhynchus* zones: the first *Leiorhynchus* zone (Zone B) in the upper part of the Marcellus Shale, the second *Leiorhynchus* zone (Zone C) in the basal Hamilton Formation, the third *Leiorhynchus* zone (Zone E) in the lower part of the Hamilton Formation, and the fourth (*Orbiculoidea* or Modified *Leiorhynchus* zone = Zone V) in the upper part of the Hamilton Formation. COOPER (1929) gave the position of these zones in terms of the stratigraphic subdivisions he adopted: Marcellus, Levanna, Ledyard, Wanakah. The first zone is characterized by *L. limitare* (VANUXEM, 1842), the three others by *L. laura* (BILLINGS, 860).

For the first three zones, CLELAND (1903, pp. 22-23) stated that the ''faunal combination of this zone [the first *Leiorhynchus* zone] does not differ materially from that of the second and third *Leiorhynchus* zones with the exception of the replacement of *L. limitare* by *L. laura*'', although both species are included in the ''composition'' of what he calls a ''*Leiorhynchus* fauna'' that is ''approximately'' the same for the three.

CLELAND went as far as writing (p. 90): ''The *Leiorhynchus* zone is several feet thick in this region. There is no objection to the supposition that such a faunule would have lived throughout the stage [Hamilton stage] had the conditions remained as they were during the deposition of that zone''.

Ironically, none of these Hamilton zones contains any representative of the genus. Further investigations and the transfer of the type species of *Leiorhynchus* HALL, 1860, *L. quadracostatus* (VANUXEM, 1842), from the earliest Frasnian to the latest Givetian (Lowermost *Mesotaxis asymmetrica* Zone) following an international decision on the position of the Givetian/Frasnian boundary, led to the establishment by the author of a North American *Leiorhynchus* Zone restricted to the late Givetian. For more information on these topics see SARTENAER (1968, p. 6; 1983, p. 43; 1984, p. 6; 1985, p. 314; 1987, pp. 125, 128; *in* NORRIS, UYENO, SARTENAER & TEDFORD, 1992, p. 48; 1995, p. 119; 1996, pp. 245, 246-247).

The Marcellus, as it is often called, is known in the literature under various names: Marcellus shale(s), black

shale(s), shales and limestones, beds, layers, aspect, facies, member, formation, stage, series, group, subgroup. The last name was proposed by VER STRAETEN, GRIFFING & BRETT (1994, p. 4), VER STRAETEN, BRETT & ALBRIGHT (1995, p. 232), and VER STRAETEN & BRETT (1997, pp. 32-34). These authors argued, among other things, that "the lower part of the Marcellus subgroup features a unique fauna that is distinctly different from the overlying upper part of the subgroup and the remainder [Skaneateles, Ludlowville, and Moscow Formations] of the Hamilton Group"; they also introduced new members, submembers and beds in the subgroup. In so doing they broke with a consensus of opinion progressively reached on the subdivision of the Hamilton Group into four formations (Marcellus, Skaneateles, Ludlowville, and Moscow) as proposed by COOPER (1929, 1930). This reshuffling is only the latest of the various interpretations to which the Marcellus has been subjected in the course of time, the major ones being: (1) its restriction or not to the basal black shales; (2) its inclusion or not in the Hamilton Group; and (3) the Eifelian or Givetian age, or both. Except for the age of the Marcellus, none of these interpretations is of any relevance to the stratigraphic range of *L. limitare*. On the other hand, the following expressions are relevant and have to be assessed with care, because they partly or entirely comprise dark gray to black shales of the Skaneateles (Levanna Shale Member) and/or of the Ludlowville (Ledyard Shale Member) Formations from which *L. limitare* is supposed to have been collected: "Marcellus fauna" (e.g. GRABAU, 1898, p. 63), "recurrent Marcellus shales" (e.g. CLARKE, 1885, p. 15), *Leiorhynchus* or Marcellus fauna (e.g. COOPER, 1930, p. 129; 1933, pp. 537-538), *Leiorhynchus* or Marcellus facies (e.g. COOPER, 1930, pp. 133, 214, 215, 217, 221, 222; 1933, p. 543), recurrent *Leiorhynchus* fauna (e.g. COOPER, 1929, p. 31, modified *Leiorhynchus* fauna (e.g. COOPER, 1929, pp. 31, 83, 112, 292), and various *Leiorhynchus* zones, faunas, community, facies, bed(s), bearing beds (shales). Expressions such as "*L. limitaris* zone" or "*L. limitaris* facies" were also used for characterizing the beds containing abundant representatives of the species (COOPER, 1929, pp. 59, 417, 470). Let us not forget also that HALL (1839, pp. 295-296) included in the original definition of the Marcellus shales the Skaneateles shales that VANUXEM (1840, p. 380) separated from them, while still recognizing the presence of the species in the Marcellus shales and in "the lower part of the Hamilton group".

The author has never been able to identify a specimen of *L. limitare* above the Oatka Creek Member or Formation; this statement is based on the examination of collections in many scientific institutions and universities around the world, and on a limited, but satisfactory, field experience. It is a conclusion already reached a century ago by CLELAND (1903, p. 43), who declared the species "confined to the Marcellus shales" in the Cayuga Lake section.

The mention of the species in the Levana Shale and Ledyard Shale Members is due to an unsatisfactory definition of the species, and to the difficulty in identifying its representatives that are crushed in the dark gray and black shales of these members. The opposition between the occurrence of *L. limitare* in the Marcellus and its alleged presence above it is best emphasized by the following statement by CHADWICK (1934, p. 351) resulting from a compilation: "*Leiorhynchus limitare*, typically Marcellus into lower Hamilton (Skaneateles)".

Complete specimens of *L. limitare* can be obtained from limestone beds of the Marcellus, but not from the overlying Stafford Limestone in which it has sometimes been reported; very well preserved specimens may also be collected from concretions in the Marcellus as pointed out by CLELAND (1903, p. 43) in Great Gully Creek near Farleys post-office. It was easy for the author to collect such specimens, allowing him to make transverse serial sections from some of them.

The systematic position of the species (*L. limitare*) characterizing the first zone mentioned above is examined in the present paper.

Family Camarotoechiidae SCHUCHERT, 1929

Subfamily Camarotoechiinae SCHUCHERT, 1929

Cherryvalleyrostrum, n. gen.

DERIVATIO NOMINIS

The name draws attention to the Cherry Valley Limestone of New York State, from which complete specimens of the type species are easy to obtain.

TYPE AND ONLY SPECIES

Limitare orthis (O. limitaris) VANUXEM, 1842.

"It is very abundant in some localities, and appears to be coëxtensive with the [Marcellus] shales and the lower part only of the Hamilton group, and to be in greater number near the junction of the two, from whence its name" (VANUXEM, 1842, p. 147).

DIAGNOSTIC FEATURES

Small-sized. Thick-set. Moderately gibbous. Shallow sulcus and low fold not starting at the beaks. Moderate number of well marked, low, and rounded costae beginning in the umbonal regions. Divisions of median costae common. Parietal costae present. Median furrow on the fold wider than the others, with a corresponding costa in the sulcus wider and higher than the others; a faint costa is generally present at the bottom of the median furrow. Maximum thickness of shell posterior to front. Wide apical angle. Shell thin. Slender and slightly convergent dental plates. Divided hinge plate. Narrow outer hinge plates. Very short and shallow septalium. Slender and lamellar septum. Slender crura, close to each other, becoming flabellum-shaped in their distal part.

Description

Small-sized, exceptionally medium-sized. Uniplicate. Thick-set. Dorsibiconvex, both valves being moderately high and evenly convex. Moderately gibbous. Contour subcircular to transversely subelliptical in ventral and dorsal views. Hinge line short. Umbonal regions without relief. Maximum thickness of shell posterior (often considerably) to front. Shallow sulcus and low fold beginning imperceptibly at a variable, sometimes great, distance from the beaks. Commissure sharp and projecting postero-laterally where valve margins are concave. Commissure only slightly undulated by the low costae.

Sulcus difficult to separate from flanks in its incipient part, starting wide, and wide at front. Bottom of sulcus generally slightly convex, exceptionally flat. Tongue low to moderately high, trapezoidal, wide, and clearly delineated; its upper part is elongated anteriorly and never tangent to a vertical plane. Top of tongue located lower than top of shell. Beak erect to slightly incurved. Ventral interarea long, with beak ridges only clearly marked near the beak. Thin deltidial plates have been observed in one of the sectioned specimens.

Top of fold generally flat, seldom slightly convex.

Moderate number of well marked, low, rounded, and wide costae beginning in the umbonal regions. Costal counts show variation in number of median and lateral costae. Number of lateral costae not always the same on both flanks. One or two, exceptionally three, median costae divided or intercalated in most specimens, one, exceptionally two, lateral costae divided in half the specimens. Median furrow on the fold wider than the other furrows; with few exceptions, a faint (very low and narrow) costa of variable length (beginning in the umbonal region or generally anterior to it) may be seen on the bottom of this furrow. A median costa in the sulcus corresponds to this furrow; it is wider and slightly higher than the other costae, and is occasionally divided near the commisssure.

Parietal costae, up to two on both flanks of sulcus and fold, generally present; they usually do not reach the commissure. Top of ventral valve located in the posterior half of the shell, but at a great distance anterior to the beak. Top of dorsal valve, and thus of the shell, located at a great distance posterior to the frontal commissure; from this point the valve curves gently toward the frontal commissure. Thus, the top of the tongue is not the highest part of the shell, but is located lower than the point of maximum shell thickness. Apical angle wide.

Shell thin. Dental plates slender, short, slightly convergent, and slightly concave. Umbonal cavities large and wide. Delthyrial cavity moderately wide. Teeth very short and robust. Hinge plate divided, very short, and moderately thick. Outer hinge plates narrow. Septalium very short and shallow, supported by a slender and lamellar septum persisting for about one-third length of valve, and thinning considerably anteriorly. Dental sockets very short, shallow, relatively wide, with low inner socket ridges. Crura slender, short, and close to each other; in transverse serial sections they are rounded to oval in their proximal part, and become boomerang-shaped and flabellum-shaped distally.

Comparisons

The type species of the genus has been consistently assigned to *Leiorhynchus*. This genus has nothing in common with *Cherryvalleyrostrum* n. gen. The type species has also been exceptionally assigned to *Camarotoechia* Hall & Clarke, 1893. As a matter of fact, *Cherryvalleyrostrum limitare* and the lower Givetian (Butternut Shale Member = the uppermost member of the Skaneateles Formation) *Camarotoechia congregata* (Conrad, 1841), the type species of the genus *Camarotoechia*, exhibit some similar features: the maximum thickness of shell posterior to front, and thus, top of tongue located lower than top of shell; the sulcus wide at front; a trapezoidal and clearly delineated tongue; the upper part of tongue elongated anteriorly and never tangent to a vertical plane; a similar apical angle; a moderate and similar number of median and lateral costae; a divided hinge plate; and a long septum.

Many characters, however, make *Cherryvalleyrostrum* n. gen. distinct from *Camarotoechia*: a slightly smaller size; a moderate gibbosity; a less variable contour; a shallower sulcus and lower fold beginning imperceptibly at a variable, sometimes great distance from the beaks; the commissure only slightly undulated by costae; low costae; divisions of median costae less systematically present, and then rarely more than one or two (most or all median costae in *Camarotoechia* are divided or intercalated, and therefore, irregular); parietal costae almost always present and amounting to one or two (in *Camarotoechia*, when present, they are either slightly lower than the dorsal median costae, either slightly higher than the ventral lateral costae, and therefore, could be counted as such; they always reach the commissure); a thinner shell; thinner and only slightly convergent dental plates; a shorter and lower septalium.

The middle to late Givetian genus *Platyglossariorhynchus* Sartenaer, 1970 is the only genus to which *Cherryvalleyrostrum*, n. gen. shows some analogy. Both genera being monospecific, the following comparison applies to their type species, *Platyglossariorhynchus proteus* (Torley, 1934) and *Cherryvalleyrostrum limitare*. The two species exhibit the following similar features: a comparable size; a thick-set appearance; a short hinge line; umbonal regions without relief; sharp commissures; a clearly delineated trapezoidal and wide tongue; a long ventral interarea with beak ridges only clearly marked near the beak; a moderate number of well marked costae; divisions of median costae common; a thin shell; short dental plates; large and wide umbonal cavities; a short hinge plate; a short septalium; a slender, lamellar and long septum.

Other characters make *Cherryvalleyrostrum limitare* distinct from *Platyglossariorhynchus proteus*: a generally smaller thickness; a lesser gibbosity (it never shows the

''pugnax-artiges Habitus'' mentioned by TORLEY, 1934, p. 73 in *P. proteus*); a less variable contour; the maximum thickness generally located more posterior to front; a generally somewhat shallower sulcus and lower fold; commissures only slightly undulated or exceptionally slightly crenulated by the costae; the top of fold generally flat; the upper part of tongue never tangent to a vertical plane; a generally slightly wider apical angle; lower, rounded, and narrower costae; a less variable number of costae; a different costal formula ($\frac{5-7}{4-6}$; $\frac{1-0}{1-0}$ to $\frac{2-1}{2-1}$; $\frac{5-6}{6-7}$ for *Cherryvalleyrostrum limitare*; $\frac{3-5}{2-4}$; 0 to $\frac{1-1}{1-1}$; $\frac{4-5}{5-6}$ for *Platyglossariorhynchus proteus*), indicating a higher number of median costae and the constant presence of parietal costae (commonly amounting to two on one or both flanks of sulcus and fold in *Cherryvalleyrostrum limitare*); the presence on the fold of a median furrow wider than the others, with usually a faint costa in its bottom, and a wider and slightly higher costa in the sulcus corresponding generally to this furrow; thin, slightly convergent and concave dental plates (they are thicker, strongly convergent and straight in *Platyglossariorhynchus proteus*); a divided and thicker hinge plate; a shallow septalium; a shorter septum; the absence of a connectivum; a radically different shape of crura.

SAVAGE (1996, p. 257; 2002, p. 1375) has included *Platyglossariorhynchus* in a list of genera labelled *nomina dubia*. This opinion is not shared by the author, because it is not in harmony with the ICZN (1999, Glossary) definition of a *nomen dubium*: a Latin term meaning ''a name of unknown or doubtful application''.

The original collection of the type species of *Platyglossariorhynchus* is housed in the ''Forschungsinstitut Senckenberg'', where it is easily accessible. The type series is composed of eleven specimens (holotype + ten paratypes), all of them figured by TORLEY (1934, fig. 3, p. 76, pl. 1, figs. 21a,b, 22a,b, 23a,b, 24a,b, 25a,b, 26a,b, 27a,b, 28a,b, 29a,b, 30a,b). Not only has *P. proteus* been fully and satisfactorily illustrated, but it has also been well described. Therefore, SARTENAER (1970, pp. 1, 2, 3, 6, 8-9) felt free to designate the species as the type species of *Platyglossariorhynchus*, of which he gave a full description. However, although TORLEY figured (fig. 3, p. 76) the septum and sectioned the beak of two paratypes (SMF XVII 334a6, 334a8) in order to include internal characters in his description of the species (the statement ''interior features unknown'' by SAVAGE, 2002, is therefore incorrect), SARTENAER (1970, p. 8) acknowledged that ''les caractères internes ne sont connus que d'une manière imparfaite''. Quite a number of genera with less ''credentials'' have not been considered as *nomina dubia*. It is the specialist's responsibility to complete or to emend the definition of a genus not considered as satisfactorily known. As it has not been done previously, the author made serial transverse sections (Text-fig. 1) of one paratype (SMF XVII 334a10) in order to give a complete picture of the internal structures of *P. proteus*.

Cherryvalleyrostrum limitare (VANUXEM, 1842)

(Text-figures 2-4)

The author doubts that the long list of citations of the species in the literature of the type area would be of much use. A question mark or/and *e.p.* would have to be written in front of most of them without the possibility to assess whether the collection came from the Marcellus as this lithostratigraphic unit was originally defined and widely accepted or from a differently defined Marcellus or from a ''recurrent Marcellus''; HALL (1839, pp. 295-296) himself, although he reconsidered his position soon after, included the Lower Hamilton shales (i.e.the Skaneateles shales) in the Marcellus, considered as an independent formation. Furthermore, although the species is dominant in the Marcellus Subgroup, the possibility that other species also assigned to *Leiorhynchus* could have been mistaken for it cannot be dismissed; figures 9, 20, 21, plate 56 *in* HALL (1867) suggest such a possibility. Further complication arises when some lithostratigraphic units have been wrongly identified, e.g. by CLARKE (1885, p. 15), and GRABAU (1899, pp. 237, 291) (see corrections by COOPER, 1929, pp. 98, 473 and 1930, pp. 217, 225).

Once these difficulties are brushed aside, and when the origin of the collection is beyond doubt, it is enough to state that all mentions of the species above the Marcellus Subgroup, notably in the Levanna Shale and Ledyard Shale Members, are not to be considered (see below).

TYPES

The original material consists of crushed specimens: One specimen and a slab showing about ten specimens figured respectively by VANUXEM (1842, fig. 35 No.3, p. 146) and HALL [1843, fig. 71 No. 11, p. 180 (= No.39, fig. 11, pp. 35-36 in tables of organic remains)]. VANUXEM's specimen was probably also on a slab and has been outlined. These specimens have not been located either in the American Museum of Natural History (New York) or in the New York State Museum and Science Service (Albany) or in the Field Museum of Natural History (Chicago).

In spite of lack of evidence, the specimen figured by VANUXEM (1842) could have been part of his collection housed in the Masonic College, Clarksville, Tennessee; to the author's knowledge this collection does not exist any more.

Complete specimens were illustrated for the first time by HALL (1867, pl. 56, figs. 6-21). Four (figs. 9, 13-14, 20, 21) of the seven figured specimens do not belong to the species as will follow from its forthcoming description. Figures 9 and 20 of HALL (1867) show strong and very wide median costae without divisions. His figure 14 shows a large number ($\frac{3-3}{3-3}$) of parietal costae and a dome-like tongue. The specimen of figure 21 has been outlined from a slab (No. 1532 = $\frac{7743}{1}$ in the New York

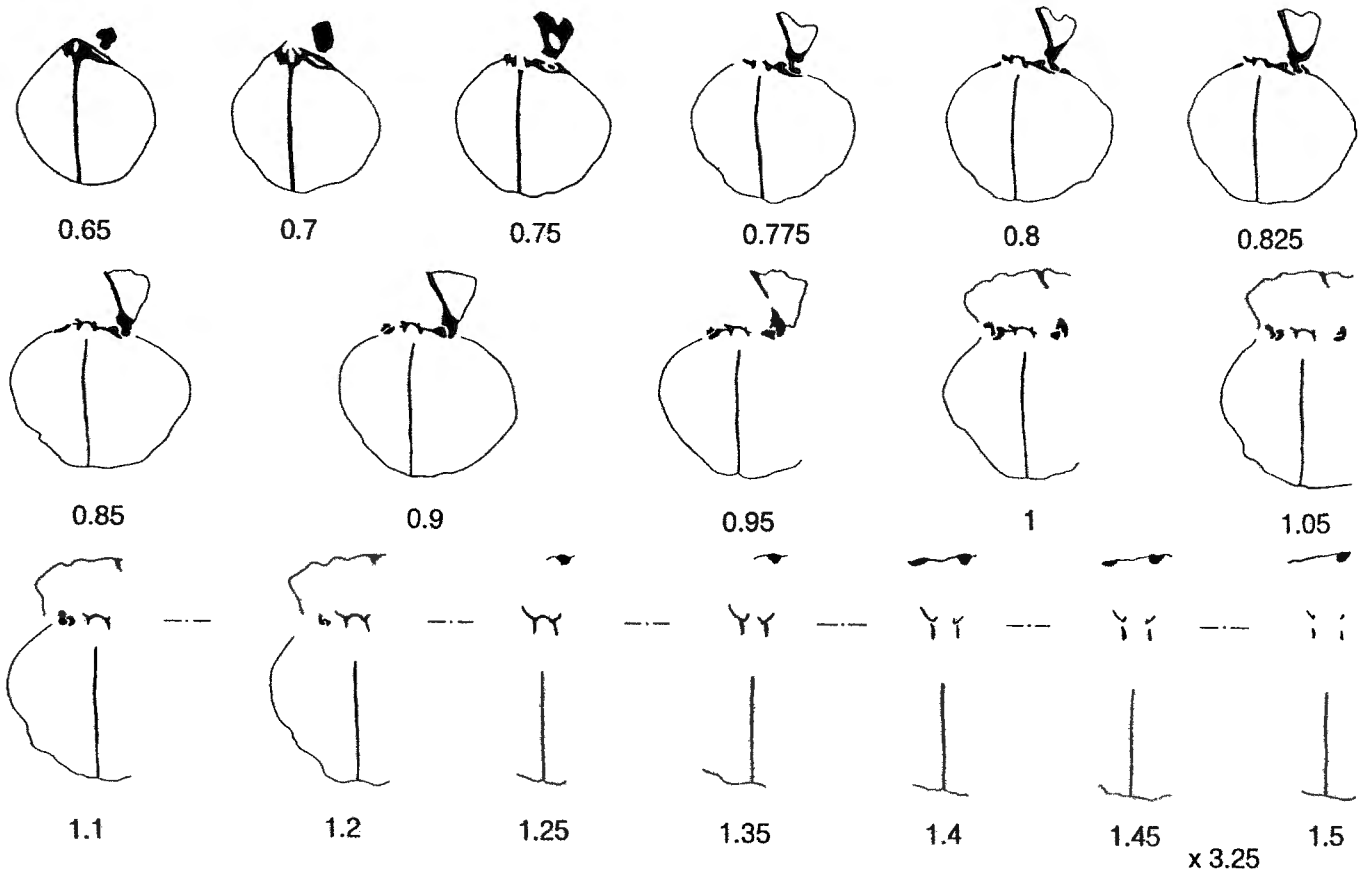

Fig. 1 — *Platyglossariorhynchus proteus* (TORLEY, 1934). Camera lucida drawings of transverse serial sections; figures are in mm forward of the dorsal umbo. Paratype, SMF (Senckenberg Museum, Frankfurt am Main) XVII 334a10. Bilveringsen, Sauerland. Massenkalk (late Givetian). Measurements: length = 13.9 mm; width = 17.3 mm; thickness = 15.05 mm.

State Museum and Science Service); it is relatively large, has many costae, notably at least ten lateral costae, three of them divided. The three remaining specimens (HALL, 1867, figs. 6-8, 10-12, 15-19) have been photographed here (Text-fig. 3) and belong to the species, but the largest of them is an exceptionally large specimen with an exceptionally wide sulcus, and the top of the shell located at front. Thus, the "principal varieties of form" advocated by HALL (1867, p. 356) does not apply to the species, which shows little variety.

If a neotype had to be designated it would need to be one of the two specimens (figs. 6-8, 10-12) giving a fair representation of the species. The author does not believe that the designation of a neotype would be of great help, because the species is characteristic, abundant, and has a restricted stratigraphic range that makes it easy to collect. Furthermore, many collections, some of them large, exist in various American and non-American museums.

The topotypes (A-K) figured, measured, and sectioned in the present paper are given the following catalogue numbers: IRScNB a12002-a12012. These types are stored in the Belgian Royal Institute of Natural Sciences.

MATERIAL

The present study is essentially based on 27 complete specimens collected by the author in 1959 and 1960 from the Cherry Valley Limestone (also known as the Goniatite or Agoniatite Limestone) in the following New York State localities: W of Manlius, Onondaga Co. (10 specimens); near Cazenovia, Madison Co. (2 specimens); Rte 20, 1.5 mi NE of Cherry Valley, Otsego Co. (2 specimens); and Schoharie, Schoharie Co. (13 specimens).

Collections have also been examined in various museums, scientific institutions and universities in and outside the USA, more particularly a collection of about 200 specimens in the American Museum of Natural History, New York, where the specimens figured by HALL (1867, pl. 56, figs. 6-21) are also housed.

DESCRIPTION

Remarks

The species is easy to identify when complete specimens are available, and WHITFIELD (1891, p. 550) properly pointed out that it "is a very well-marked species and

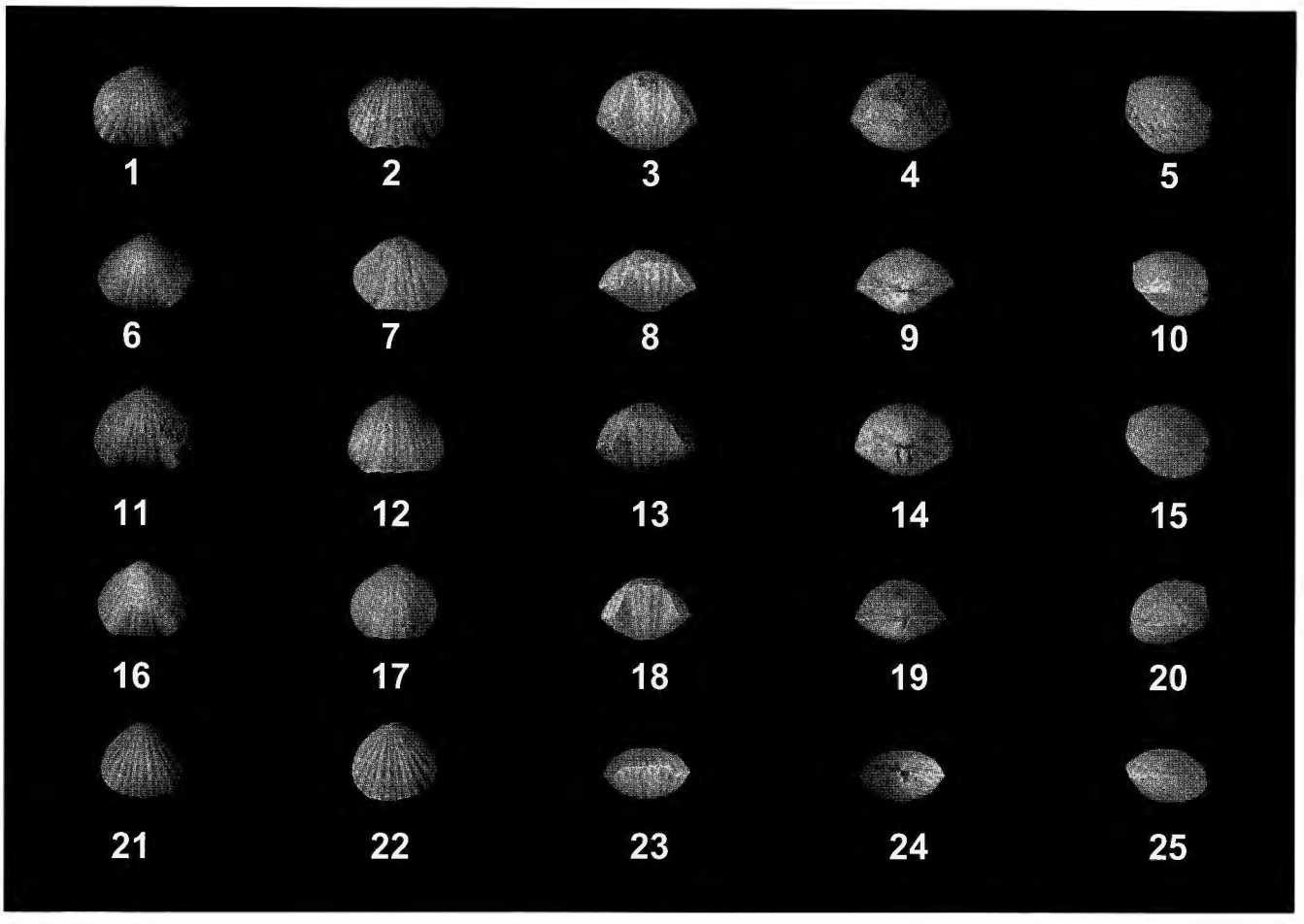

Fig. 2 — *Cherryvalleyrostrum limitare* (VANUXEM, 1842). 1-5: Topotype A, IRScNB a12002. Schoharie, Schoharie County, New York. Cherry Valley Limestone. Collector: P. Sartenaer, 1959. Ventral, dorsal, anterior, posterior, and lateral views. Costal formula: $\frac{6}{4}$; $\frac{0-2}{0-2}$; $\frac{6}{7}$. 6-10: Topotype C, IRScNB a12004. Same locality, formation and collector. Ventral, dorsal, anterior, posterior, and lateral views. Costal formula: $\frac{5}{4}$; $\frac{1-1}{1-1}$; $\frac{6}{7}$ and $\frac{5}{6}$. 11-15: Topotype D, IRScNB a12005. Same locality, formation and collector. Ventral, dorsal, anterior, posterior, and lateral views. Costal formula: $\frac{5}{3}$; $\frac{1-1}{1-1}$; $\frac{5}{6}$. 16-20: Topotype E, IRScNB a12006. Same locality, formation and collector. Ventral, dorsal, anterior, posterior, and lateral views. Costal formula: $\frac{6}{5}$; $\frac{1-1}{1-1}$; $\frac{6}{7}$ and $\frac{5}{6}$. 21-25: Topotype H, IRScNB a12009. Same locality, formation and collector. Ventral, dorsal, anterior, posterior, and lateral views. Costal formula: $\frac{7}{6}$; $\frac{1-0}{1-0}$; $\frac{4}{5}$. All figures natural size.

cannot well be mistaken for any other of the several species, which, so far as is yet known, are limited to certain horizons; this one characterizing the horizon of the Marcellus shale in New York, wherever the species has been found''. Unfortunately only crushed specimens were collected during the pioneer period of the study of the geology of New York State as demonstrated by VANUXEM (1842, fig. 35 No.3, p. 146) and HALL [1843, fig. 71 No.11, p. 180 (= No.39, fig. 11, p. 36 in Tables of organic remains)], who illustrated the species by woodcuts of, respectively, one specimen and a slab showing about ten such specimens. Furthermore, VANUXEM (1842) did not describe the species he established, and HALL (1843, p. 182) gave only a one line description: ''compressed, somewhat circular; surface covered with radiating ribs of nearly equal size''. This was hardly compensated by the following three line description by HALL (1860, p. 85): ''shell moderately gibbous, subcircular or transverse. Dorsal valve with a broad mesial elevation. Ventral valve with sinus only on the anterior portion. Surface covered by numerous fine plications.''

This inadequate original introduction of the species is one of the major reasons for its poor subsequent understanding. This is best demonstrated by the answer given seventy years later by SCHUCHERT to a question by PROSSER (*in* PROSSER & KINDLE, 1913, p. 177), who submitted to him specimens from the lower part of the Romney Formation of Maryland supposed to belong to the species:

"It is very difficult to be certain of these crushed specimens, but they are usually called *Leiorhynchus limitare* when from the Marcellus". This statement contains a teaching and an important restriction. The teaching is that it was customary at that time – it is still customary nowadays – to identify as *L. limitare* any crushed specimen of small to medium size with radial costae supposed to be assignable to the genus *Leiorhynchus*, i.e. *L. dubius* HALL, 1867, *L. multicosta* HALL, 1860, *L. laura* [originally *Rhynconella* (?) *Laura*, presently *Eumetabolotoechia laura*], or even to *C. congregata*, the type species of *Camarotoechia*. As a consequence, *Leiorhynchus limitare* acquired a wide stratigraphic range. SCHUCHERT did not fall into the trap, because, as mentioned above, his observation applied only to specimens "from the Marcellus". The incorrect assumption by HALL (1860, p. 85; 1867, p. 356), and GRABAU (1899, p. 233) that the New York species had "numerous (fine, angular or subangular, mostly simple) plications" did not help to clarify the situation, but added to the confusion still persisting.

The first full description of the species is by HALL (1867, p. 356, pl. 56, figs. 6-21).

The description by WOOD (1901, pp. 163-164) of "the considerable variations among the shells referred to this species [*Liorhynchus limitare*]" in the various beds of the Marcellus shale and the Marcellus (Stafford) limestone of Lancaster (Erie Co., New York) is worth mentioning.

Outside New York, specimens allegedly assigned to the species have been described in Pennsylvania by ROGERS (1858, p. 826), in Ohio by WHITFIELD (1891, p. 550), in Virginia by KINDLE (1912, p. 80), and in Maryland by PROSSER (*in* PROSSER & KINDLE, 1913, pp. 175-177).

The following description refers only to specific characters in need of further elaboration.

Measurements of ten specimens, of which five have been photographed, are given on Table 1. Columns 1 to 6 refer to adult specimens (columns 1 and 2 to the largest specimens at the author's disposal), columns 7 and 9 to ephebic specimens, and columns 8 and 10 to the smallest specimens at hand.

Width is the greatest dimension. Maximum width occurs at a point between 55 and 68 per cent (most of the values varying between 55 and 61 per cent) of the shell length anterior to the ventral beak. Thickness of dorsal valve varying between 57 and 68 per cent (in adult specimens) of the shell thickness. Top of ventral valve located

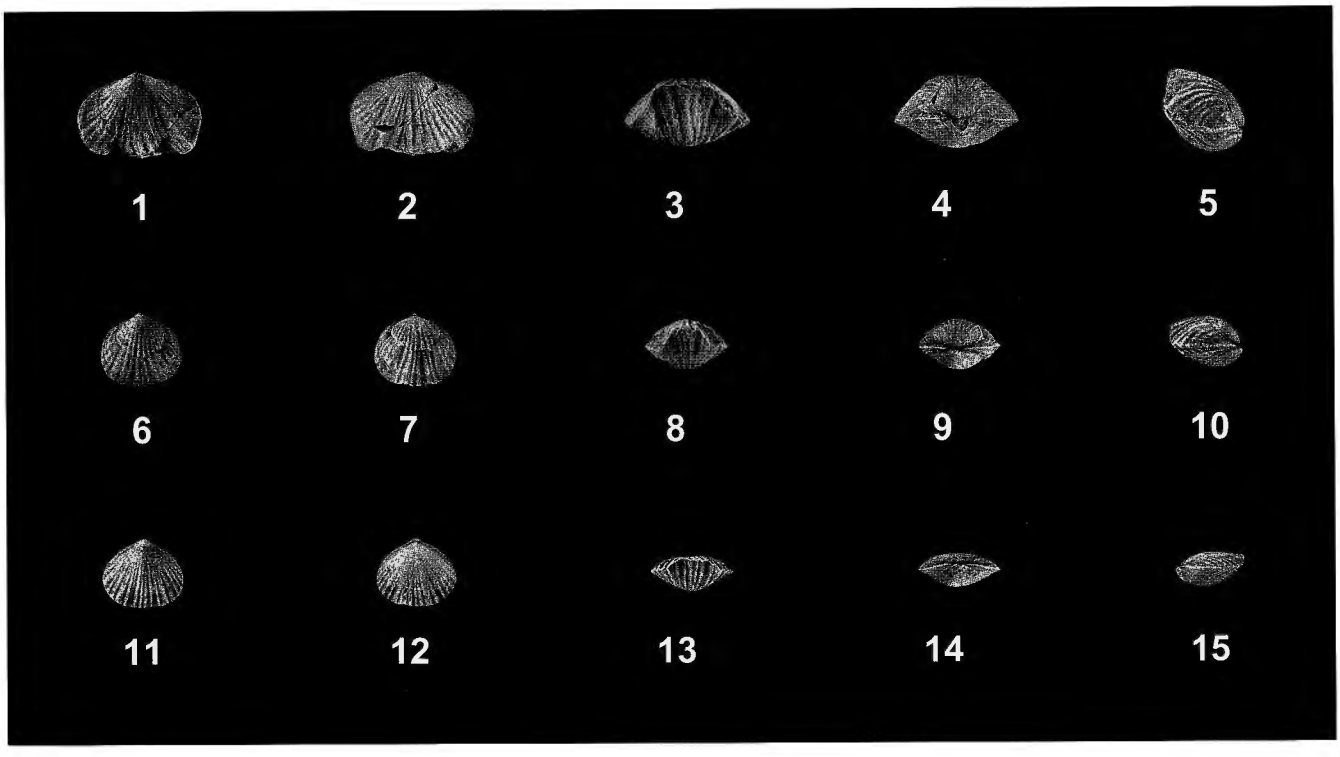

Fig. 3 — *Leiorhynchus limitaris*. 1-5: Topotype, AMNH (American Museum of Natural History, New York) 31691 (formerly $\frac{4383}{1}$) (= pl. 56, figs. 15-19 in HALL, 1867). Limestone of the Marcellus shales, Avon, New York. 6-10: Topotype, AMNH 31690 (formerly $\frac{4383}{1}$) (= pl. 56, figs. 10-12 in HALL, 1867). Marcellus shales (Goniatite limestone), Schoharie Co., New York. 11-15: Topotype, AMNH 31689 (formerly $\frac{4383}{1}$) (= pl. 56, figs. 6-8 in HALL,1867). Probably Marcellus shales (Goniatite limestone), Schoharie, New York.

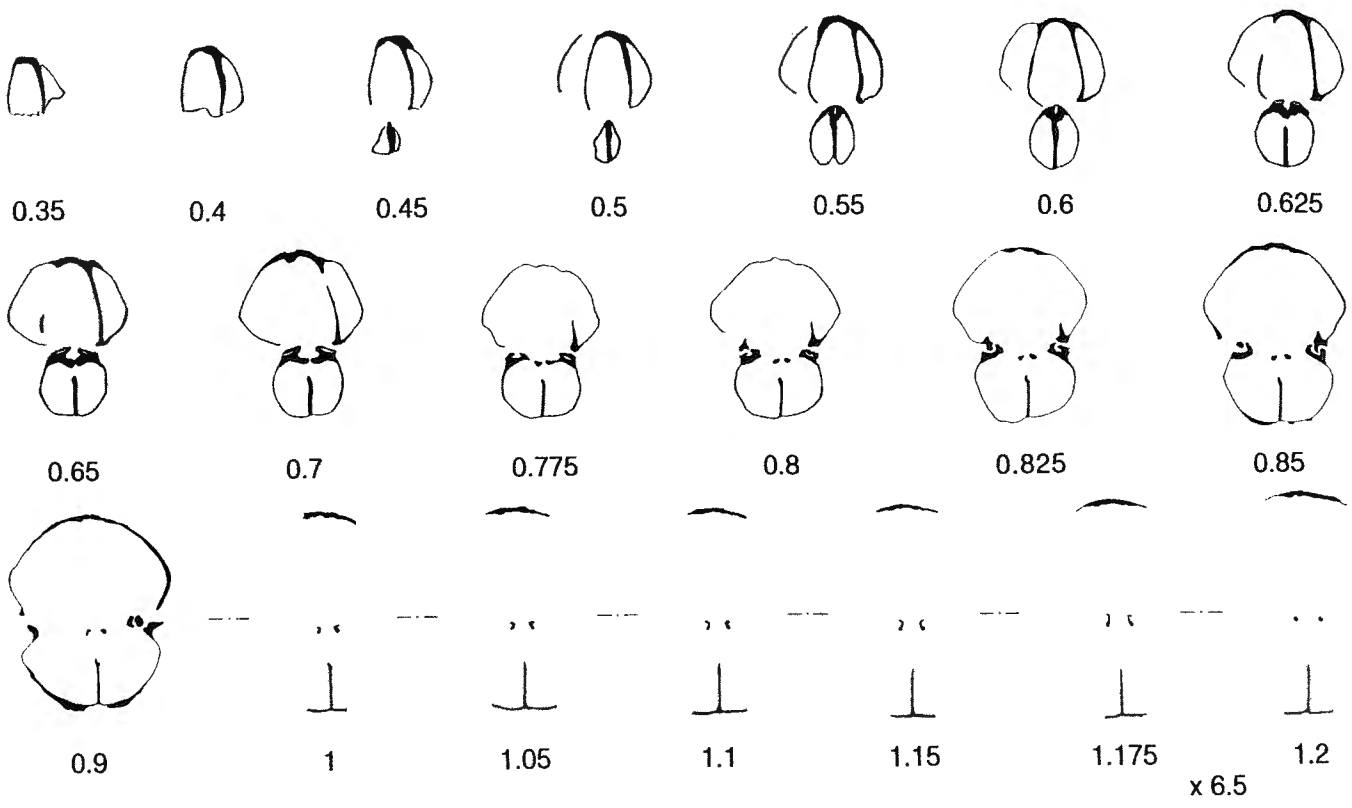

Fig. 4 — *Cherryvalleyrostrum limitare* (VANUXEM, 1842). Camera lucida drawings of transverse serial sections; figures are in mm forward of the ventral umbo. Topotype K, IRScNB a12012. Near Cazenovia, Madison County, New York. Cherry Valley Limestone. Measurements: length = (10.2) mm; width = 11.4 mm; thickness = 7.5 mm.

Table 1 — Measurements (in mm) based on ten specimens: figures in parentheses are reasonable estimates on damaged specimens. Abbreviations used: l = length; w = width; t = thickness; vv = ventral valve; dv = dorsal valve.

in mm	Topotype A	Topotype B	Topotype C	Topotype D	Topotype E	Topotype F	Topotype G	Topotype H	Topotype I	Topotype J
l	(12.8)	11.8	11.2	10.9	10.9	10.7	10.5	(9.8)	9.5	9.4
w	14.5	14.9	14.3	13	12.2	13.6	11.3	10.1	11	9.6
lvv unrolled	(20)	15.5	16	16.2	15	15.7	14.5	12.4	14.7	12.2
t	11.1	7.5	9.1	9.9	8.4	8.2	6.7	6.2	7.5	5.8
tvv	4.5	3.1	3.1	4.3	2.7	3.5	3.1	3	2.5	2.7
tdv	6.6	4.4	6	5.6	5.7	4.7	3.6	3.2	5	3.1
l/w	(0.88)	0.79	0.78	0.84	0.89	0.79	0.93	(0.97)	0.86	0.98
t/w	0.77	0.50	0.64	0.76	0.69	0.60	0.59	0.61	0.68	0.60
t/l	(0.87)	0.64	0.81	0.91	0.77	0.77	0.64	(0.63)	0.79	0.62
apical angle	121°	126°	118°	120°	119°	127°	117°	(115°)	115°	110°

Table 2 — Number of median, parietal, and lateral costae.

Median costae			Parietal costae			Lateral costae		
Number of costae	Number of specimens	%	Number of costae	Number of specimens	%	Number of costae	Number of specimens	%
4/3	1	4.8	0-1/0-1	3	14.3	4/5	3	10.3
5/3	2	9.5	1-0/1-0	3	14.3	5/6	12	41.4
5/4	7	33.2	1-1/1-1	7	33.2	6/7	10	34.5
6/4	1	4.8	1-2/1-2	1	4.8	7/8	4	13.8
6/5	1	4.8	0-2/0-2	1	4.8		29	100
7/6	6	28.6	2-1/2-1	5	23.8			
8/7	2	9.5	2-2/2-2	1	4.8			
9/8	1	4.8		21	100			
	21	100						

at a variable point between 33 and 46 per cent, and top of dorsal valve, and thus of the shell, at a point between 46 and 62 per cent of the shell length anterior to the ventral beak. In one specimen figured by HALL (1867, pl. 56, figs. 15-19), the top of the dorsal valve is at the front; this is the only exception known to the author. Top of tongue located 14 to 20 per cent lower than the point of maximum shell thickness

Sulcus starting at 9 to 44 per cent of the shell length, most of the values varying from 9 to 32 per cent, or 16 to 51 per cent of the unrolled length of the valve, most of the values varying from 16 to 37 per cent. Width of sulcus at front varying between 54 and 73 per cent [most of the values between 54 and 65 per cent of the shell width; 73 per cent is the exceptionally large width of sulcus of the exceptional specimen figured by HALL (1867, pl. 56, figs. 15-19, and Fig. 3, 1-5 in the present paper].

The general costal formula, which is a grouping of at least 75 per cent of the specimens in median, parietal, and lateral categories, is $\frac{5-7}{4-6}; \frac{1-0}{1-0}$ to $\frac{2-1}{2-1}; \frac{5-6}{6-7}$. The ratios of median and lateral costae (in specimens in which such observations are possible) are given on Table 2. Width of median costae at front varies between 0.75 and 1.5 mm. Of 21 specimens, eight show one division on the fold, five show two, two show three, and six none. A faint costa on the bottom of the median furrow of the fold has been observed in 15 specimens out of 21.

Apical angle varying (in adult specimens) between 117° and 127°; 137° is the exceptionally wide angle of the exceptional specimen figured by HALL (1867, pl. 56, figs. 15-19).

Transverse serial sections of one specimen (topotype K, IRScNB a12012) are shown in Text-figure 4; they are the first sections ever made in a specimen of *Cherryvalleyrostrum limitare*.

STRATIGRAPHICAL RANGE AND GEOGRAPHICAL DISTRIBUTION

C. limitare is restricted to the Marcellus Formation or Subgroup, i.e. to the first *Leiorhynchus* zone established by CLELAND (1903) [although COOPER (1930, p. 131, footnote 7) considers this zone as corresponding only to the Oatka Creek Shale], or to the *L. limitare* assemblage, one of the pelagic or epipelagic assemblages of the Marcellus defined by BROWER *et al.* (1978, pp. 104, 105, table 3, p. 107, pp. 118, 119).

It is to be expected that studies by regional geologists will further restrict the range of the species within the Marcellus.

Conodont information about the Marcellus Subgroup and the Skaneateles Formation is very scanty. The Cherry Valley Limestone Member and the *Werneroceras* Bed about one foot below belong to the *Tortodus kockelianus kockelianus* Zone as demonstrated by KLAPPER & ZIEGLER (1967, fig. 1, p. 71), and KLAPPER (1971, pp. 59-62, 68; *in* KLAPPER & ZIEGLER, 1979, fig. 4, p. 209; 1981, p. 60). Zonally diagnostic conodonts "have not been recovered from beds in the Marcellus Formation above the top of the Cherry Valley Member" according to KLAPPER (1981, p. 60). As a consequence, indications given below must be considered conjectural.

The upper limit of the Marcellus Subgroup has been questionably drawn at the base of the latest Eifelian *Polygnathus xylus ensensis* Zone by KLAPPER (1981, p. 61, fig. 2, p. 62) on the basis of the following information: the presence of *Icriodus latericrescens latericrescens* in the Delphi Station Shale and Sandstone Member and in the uppermost Levanna Shale Member, as well as its lowest New York occurrence in the Mottville Sandstone and Limestone Member, suggesting a conodont and a megafaunal correlation with limestones from the Silica Shale of nortwestern Ohio assigned to this zone.

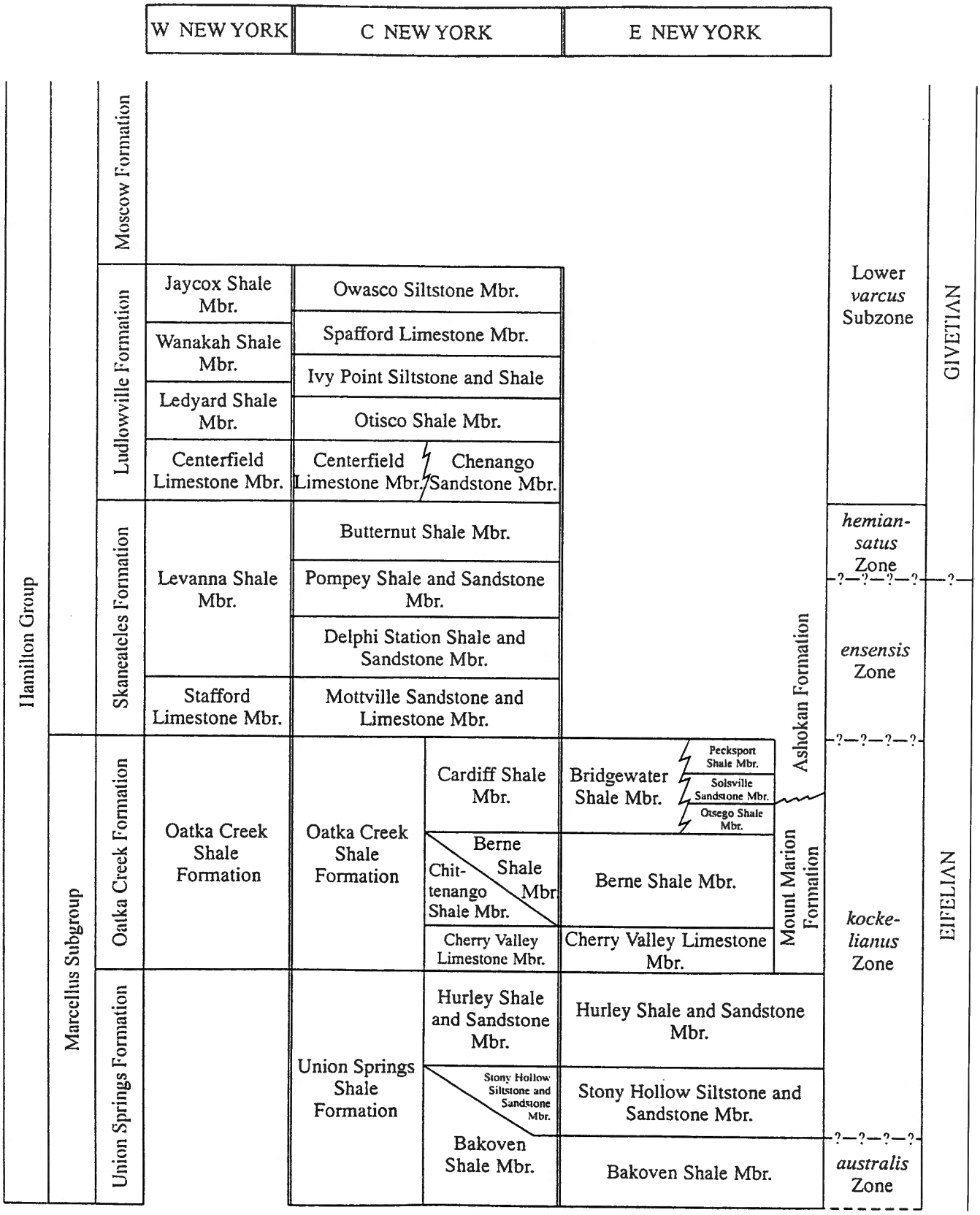

Fig. 5 — Subdivisions of the late Eifelian, and Lower and Middle Givetian in western, central, and eastern New York State.

The association of *Polygnathus costatus costatus* and *P. linguiformis linguiformis* γ morphotype in a fauna from low in the Union Springs Shale Formation allowed KLAPPER (1981, p. 60) to trace the lower limit of the Marcellus Subgroup either within the *P. costatus costatus* or the *Tortodus kockelianus australis* Zone. This information has been complemented by VER STRAETEN & BRETT (1997, p. 33), who assigned the Bakoven Shale Member to the *T. kockelianus australis* Zone and placed the Hurley Shale and Sandstone Member, and questionably the Stony Hollow Siltstone and Sandstone Member, within the *T. kockelianus kockelianus* Zone. The part of the Oatka Creek Shale Formation above the Cherry Valley Limestone Member is provisonally put in the *Tortodus kockelianus kockelianus* Zone following KLAPPER *in* KLAPPER & ZIEGLER (1979, fig. 4, p. 209), and JOHNSON, KLAPPER & SANDBERG (1985, fig. 8, p. 579).

The base of the *Polygnathus hemiansatus* Zone, and thus of the Givetian, is arbitrarily placed in Text-figure 5 in the middle of the Levanna Shale Member; this zone has not been detected thus far in New York State.

Cherryvalleyrostrum limitare is present in almost the whole Marcellus Subgroup for nearly 250 miles along outcrops from western (E of Buffalo) to eastern New York (W of Albany).

In North America, outside of New York State, the species has been mentioned in the following American States and in the adjacent Ontario Province of Canada: S Indiana [e.g. KINDLE (1899, pp. 11, 61, 111; 1901, pp. 552, 571-572); CAMPBELL, 1946, pp. 841, 868]; C Kentucky (e.g. WHITFIELD, 1875, pp. 181-182; KINDLE, 1899, p. 111); Maryland [e.g. KINDLE, 1912, pp. 35-37; PROSSER *in* PROSSER & KINDLE, 1913, pp. 175, 177, pl. 15, figs. 6-8; PROSSER *et al.* 1913, pp. 50, 54, 55, 60, 61, 62, 70, 71, 75, 80, 93, 94, 95, 98, 106; AMSDEN, 1951, table 4, p. 99, p. 121, pl. 5, figs. 15, 16; SWARTZ, 1958, pl. 11, fig. 15 = pl. 15, fig. 6 *in* PROSSER (*in* PROSSER & KINDLE, 1913)]; New Jersey (e.g. VER STRAETEN *et al.*, 1995, p. 232); C, NE and NC Ohio [e.g. WHITFIELD (1880, pp. 297, 299; 1891, pp. 535, 550, pl. 11, fig. 11; 1893, pp. 432, 440, 444, pl. 7, fig. 11); NEWBERRY, 1889, p. 58; SCHUCHERT, 1897, p. 237, PROSSER (1905, pp. 418, 429; 1912, p. 515); GRABAU & SHIMER, 1909, p. 289; STAUFFER, 1909, pp. 31, 53, 55, 56, 57, 60, 62, 78, 81, 86, 124, 130, 163; STEWART, 1955, pp. 152, 157, 158, 167; HOOVER, 1960, appendix, p. 139; CONKIN & CONKIN, 1975, fig. 2, p. 101, p. 115]; E, C and SC Pennsylvania [e.g. ROGERS (1858, p. 826, fig. 652); LESLEY, 1889, pp. xxviii, 306, fig. 8 = fig. 652 *in* ROGERS, 1858; KINDLE, 1912, pp. 27, 28; BUTTS, 1918, p. 532; WILLARD (1932, p. 229; 1935, table 1, p. 1280; 1937, table 1, p. 1247; 1939, pp. 171, 172, 174, 175, 184, table 23, p. 186, pp. 193, 194, 408, pl. 19, fig. 28; 1957, p. 2302); ELLISON, 1963, pp. 202, 204, 208]; Virginia (e.g. DARTON, 1892, p. 17; WILLIAMS & KINDLE, 1905, pp. 40, 42, 50, table, p. 51, p. 53, chart between p. 54 and p. 55; KINDLE, 1912, pp. 44, 80); West Virginia (e.g. DARTON, 1892, p. 17; KINDLE, 1912, p. 40; PRICE *et al.* (1938, p. 74, pl. 97, fig. 6, p. 178 = pl. 15, fig. 8 in PROSSER & KINDLE, 1913); SW Ontario (e.g. STAUFFER, 1915, pp. 47, 108, 130, 238).

For various reasons (destruction by fire, lost, etc...) collections related to Survey reports were seldom available to the author. This has also been the case for collections supposed to be housed in museums, scientific institutions and universities. Therefore, the author depended chiefly on his own collections and on figures published in the literature. Consequently the following statements, although carefully pondered, have to be taken with a grain of salt.

The species is not present in the New Albany Shale (late Givetian + Upper Devonian) of Kentucky and Indiana. It is most probably present in the regional Marcellus (black) shale of Maryland, Virginia, West Virginia, and in the black shale facies of the Marcellus Subgroup of New Jersey. The species has been mentioned in the late Eifelian Delaware Limestone, the early Givetian Plum Brook Shale, and the late Devonian Huron Shale of Ohio. The author can only concur with the presence of the species in the lower beds of the Delaware Limestone, from which, in 1960, he collected five specimens in a quarry located S of Delaware City. In Pennsylvania the species has been mentioned in the Marcellus Formation both in its lower (Shamokin) and upper (Brodhead Shale) members, and in the Mahantango Formation, the two formations forming the Hamilton Group. It has even been mentioned questionably in the Tully Limestone. The presence of the species in the Marcellus Formation is probable, although the published figures are not convincing (large size, costae starting from the beaks, etc...). On the other hand, its presence in the "recurrent Marcellus" faunas in the lower and middle parts, and near the top of the Mahantango Formation have to be rejected.

The species has also been mentioned in the Province of Alberta, Canada, and, outside of North America, in various regions [e.g. Germany (Sauerland), Russia (Bashkiria, Pechora area, Volga-Urals region), Turkey]. A complete list of these would not serve any purpose; therefore, reference is made only to the two publications including figured specimens: CHERNYSHEV (1887, p. 93, table between p. 124 and 125, pp. 126, 128, 177, 184, 186, pl. 14, figs. 5a-d; Late Devonian, Urals); NALIVKIN (1947, pp. 19, 89, pl. 20, figs. 5a,b.; Givetian and Frasnian, Urals).

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Paul SARTENAER
Département de Paléontologie
Section des Invertébrés Fossiles
Institut royal des Sciences naturelles de Belgique
rue Vautier, 29, B - 1000 Brussels, Belgium
e-mail: Paul.Sartenaer@naturalsciences.be

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