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FOSSILS FROM THE LATE
MIDDLE CAMBRIAN BOLASPIDELLA ZONE
OF MENDOZA, ARGENTINA

BY

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i kommission hos Ejnar Munksgaard

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Synopsis

Twenty-five species, mainly trilobites, from the Cambrian of Cerillo El Solitario in the province of Mendoza are described and discussed, and five new genera and eighteen new species are defined. The occurrence of the North American, Pacific genus *Bolaspidella* and a considerable number of Acado-Baltic agnostid genera in the fauna shows that the strata should be correlated with the late Cambrian, Pacific *Bolaspidella* zone of North America and the *Jincella brachymetopa* zone of the Acado-Baltic *Paradoxides forchhammeri* stage, respectively.

Introduction

The geological and palaeontological research carried out in Argentina October 1954 to March 1955 by VALDEMAR POULSEN, M. Sc., and the writer was made possible by means of generous financial support from the Williams Foundation, Buenos Aires. The writer is also greatly indebted to Mr. T. J. WILLIAMS, K. D., and all members of his staff for their constant efforts to make our stay in Argentina a pleasant and unforgettable experience. He likewise wishes to express his gratitude to the Carlsberg Foundation and to the Danish State Research Foundation for financial support covering expenses in connection with the voyage and the purchase of scientific equipment, respectively.

Special acknowledgements are made to Professor, Dr. ARMANDO F. LEANZA of the Geological Institute of the University of Buenos Aires for allowing the writer to study his important collections of Lower Palaeozoic fossils from Argentina.

Finally the writer is indebted to Professor CARLOS RUSCONI, Director of the Natural History Museum of Mendoza, for kind permission to study selected fossils from the Cambro-Ordovician of the San Isidro region west of the city of Mendoza.

The main task of the expedition was a study of the Cambrian sections of the San Isidro region in connection with collection of fossils for the Mineralogical-Geological Institute of the University of Copenhagen. As a result of this study and collection VALDEMAR POULSEN published a paper in 1958 under the title of "Contributions to the Middle Cambrian Paleontology and Stratigraphy of Argentina" (Matematisk-fysiske Meddelelser udgivet af Det Kongelige Danske Videnskabernes Selskab, Bd. 31, No. 8).

It was planned to continue the collection of Cambrian fossils at San Isidro to the end of our stay in Argentina, but heavy rain in the mountains resulted in swelling rivers and destruction of roads so as to prevent further activity in this region. It was therefore decided to spend the last few days

at Cerrillo El Solitario, a hill at Canota, 36 km north of the city of Mendoza, where RUSCONI has discovered a rich and in several respects highly interesting Cambrian fauna, described in papers of 1950, 1951, and 1952. A fairly rich palaeontological material was collected here, containing several new genera and species and forming a considerable supplement to the material described by RUSCONI. This new material, described and discussed in the present paper, is preserved in the Mineralogical-Geological Institute of the University of Copenhagen.

It should be noted that circumstances beyond the writer's control prevented direct comparison with RUSCONI's material so that any comparison with his specimens and comments on generic determinations are founded on his descriptions and figures.

All figures in the plates accompanying this paper are photographs taken by the writer; the prints have been made with great care and ability by Mr. C. HALKIER.

Remarks on the Locality, Cerrillo el Solitario

Cerrillo El Solitario is a small hill in the Canota region 36 km north of the city of Mendoza. The hill is the summit of a mountain the lower part of which is completely covered by a huge alluvial cone forming the surrounding Pampa. The sections in the hill show a 50 m series of strongly sloping strata, mainly dark limestone, which form an isolated stratigraphic unit without connection with younger and older formations.

Descriptions of Genera and Species

Phylum **MOLLUSCOIDEA**

Class **BRACHIOPODA**

Order **ATREMATA** BEECHER, 1891

Superfamily **OBOLACEA** SCHUCHERT, 1896

Family **OBOLIDAE** KING, 1846

Subfamily **BICIINAE** WALCOTT, 1908

Genus *Dicellomus* HALL, 1873

Dicellomus? sp. ind.

Pl. 1, fig. 1

Material: Two ventral valves.

Remarks: The specimens are fairly similar to *Dicellomus appalachia* WALCOTT, but they are not preserved well enough for accurate comparison.

Phylum **MOLLUSCA**

Class uncertain

Order uncertain

Family **HYOLITHIDAE** NICHOLSON

Genus *Orthotheca* NOVAK, 1887

Orthotheca sp.

Pl. 1, fig. 2

Material: Eight more or less fragmentary specimens.

Description: Shell rather rapidly increasing in width, with an apical angle of 11° and a rounded triangular cross-section. Dorsal face more flat

than ventral ones, sometimes even with a shallow median depression. External surface smooth to the naked eye, but a high-power lens ($\times 20$ or more) reveals surface markings consisting of extremely delicate, very closely set transversal striae. Operculum unknown.

Dimensions:

Length of figured specimen 7.0 mm
 Maximum diameter of the same .. 1.6 -

Phylum **ARTHROPODA**

Class **TRILOBITA**

Order **AGNOSTIDA** KOBAYASHI, 1935

In his excellent monograph of 1946, "Agnostidea of the Middle Cambrian of Sweden", WESTERGÅRD pointed out that opinions diverge greatly with regard to the taxonomic position of a great many genera, and that "much work remains to be done before it is possible to establish a safe phyletic foundation"; he also pointed out that in many cases the criteria or combinations of characters used by several authors fail to give a reliable answer to the question whether an individual form is referable to one or the other family or subfamily. The present writer is of opinion that WESTERGÅRD's judgment deserves much consideration, and, accordingly, the following ten agnostidean genera are simply described in alphabetic order under the heading:

Suborder **Agnostidea** SALTER, 1852

Genus **Agnostus** BRONGNIART, 1822

Agnostus exsulatus n. sp.

Pl. 1, figs. 3—4

Material: Two cephalata and two pygidia.

Description: Cephalon and pygidium of moderate convexity, a little wider than long, rounded subquadrate in outline. Axial furrows of cephalon well-defined throughout. Glabella occupying about 0.75 of cephalic length and 0.28 of width, slightly elevated above genae, parallel-sided, evenly rounded in front; anterior glabellar lobe slightly wider than long, occupying about 0.33 of glabellar length; transverse glabellar furrow well-defined

throughout; posterior glabellar lobe attaining its highest convexity in the rear, with median tubercle situated opposite anterior ends of basal lobes. Basal lobes relatively large, subequilateral, connected by very narrow band. Genae separated anteriorly by well-defined preglabellar median furrow. Cephalic border narrow, fairly prominent, defined by wide, deeply impressed border furrow.

Thorax unknown.

Axial furrows of pygidium well-defined throughout. Axis occupying about 0.8 of pygidial length and about 0.4 of width, almost parallel-sided, broadly rounded posteriorly, yet with a tendency to become slightly pointed, divided by indistinctly defined furrows into 2 axial rings and a posterior portion without indication of segmentation; second axial ring with elongate median tubercle posteriorly. Pleural fields of uniform width for the greater part of their length, separated by faintly marked posterior median furrow. Border like that of the cephalon, but with a pair of marginal spines opposite axial termination.

Judging from small, well preserved parts of pygidial exoskeleton the external surface of *Agnostus exsulatus* is smooth.

Dimensions: Cephalon (holotype) 3 mm long and 3.7 mm wide; figured pygidium 2.9 mm long and 3.5 mm wide.

Remarks: *Agnostus exsulatus* displays a close resemblance to *A. pisi-formis* (LINNAEUS), but it is distinct from the latter by having rounded subquadrate cephalic and pygidial outline and shorter glabella with median tubercle of posterior glabellar lobe opposite anterior ends of basal lobes.

Genus *Baltagnostus* LOCHMAN, 1944

Baltagnostus hospitus n. sp.

Pl. 1, figs. 5—6

Material: Two cephalata and an associated pygidium.

Description: Cephalon rounded subquadrate, slightly wider than long, moderately convex. Axial furrows well-defined throughout, wide posteriorly, narrow anteriorly. Glabella occupying about 0.6 of cephalic length and about 0.3 of width, moderately convex, practically parallel-sided, evenly rounded in front; anterior glabellar lobe low, semicircular, occupying 0.35 of glabellar length; transverse glabellar furrow narrow; posterior glabellar lobe subrectangular, with indistinctly defined, oblong median node or keel. Basal lobes small, subequilateral. Genae of uniform width throughout,

confluent, regularly convex. Cephalic border narrow, moderately convex, defined by distinctly marked, narrow border furrow.

Thorax unknown.

Pygidium slightly wider than long, rounded subquadrate, moderately convex. Axis defined by relatively wide, well impressed axial furrows, occupying about 0.85 of pygidial length and about 0.4 of width, moderately convex, with slightly expanded posterior third, broadly rounded posteriorly, touching border furrow at median line; axial segmentation almost effaced, but 2 pairs of shallow notches indicate the presence of 2 anterior axial rings, the second of them carrying an indistinctly defined median tubercle. Border furrow slightly wider than that of the cephalon. Border narrow, almost flat, with a minute, blunt marginal spine on each side opposite axial termination.

Surface of exoskeleton smooth.

Dimensions: Pygidium (holotype) 3 mm long and 3.4 mm wide; figured cephalon 2.5 mm long and 2.7 mm wide.

Remarks: Unfortunately, the holotype of the type species of *Baltagnostus* (*Proagnostus? centerensis* RESSER, 1938) is poorly preserved, and accordingly, it is difficult to use it for comparisons with other species of the genus. Nevertheless it is evident that *Baltagnostus hospitus* must be closely related to *B. centerensis* (RESSER) and that it differs from the latter in having wider cephalon with wider glabella and shorter preglabellar field, and wider pygidium with reduced or poorly developed marginal spines. LOCHMAN (1944) referred two other species to *Baltagnostus*, viz. *B. maryvillensis* (RESSER) and *B. beltensis* LOCHMAN; *B. hospitus* differs from the former in having a wider pygidium, and it is distinct from the latter by having a wider pygidium with angular outline and narrower axis. It is possible that the associated cephalon provisionally combined with the holotype pygidium may belong to *Peronopsis ultima* n. sp. (p. 13).

Baltagnostus mendozensis n. sp.

Pl. 1, fig. 7

Material: Two pygidia.

Description: Pygidium fairly convex, as long as wide, rounded subquadrate in outline. Axial furrows fairly wide and deeply impressed anteriorly, narrow and shallow posteriorly. Axis occupying about 0.8—0.9 of total length and about 0.5 of total width, unfurrowed, moderately convex, with slightly expanded posterior third, broadly rounded posteriorly, touching border furrow at median line, and carrying a small, oblong median node in

place corresponding to second axial ring. Border furrow narrow, but distinctly defined. Border narrow, almost flat, with a minute, acute marginal spine on each side opposite axial termination.

Surface smooth.

Dimensions: Length and width of holotype pygidium 2.6 mm (width estimated); length and width of smaller pygidium 1.7 mm.

Remarks: The unfurrowed pygidial axis of *Baltagnostus mendozensis* serves to distinguish this species from hitherto known species except *B. bel-tensis* LOCHMAN; the pygidium differs from that of the latter in having a rounded subquadrate outline, narrower border furrow, narrower border with acute marginal spines, and a smooth surface.

Genus *Clavagnostus* HOWELL, 1937

Clavagnostus chipiquensis (RUSCONI, 1952)

Pl. 1, fig. 14

1952. *Culipagnostus chipiquensis* RUSCONI, Rev. Mus. Hist. Nat. Mendoza, Vol. 6, p. 11.

1952. ?*Triplagnostus chipiquensis* RUSCONI, ibid., pl. 1, fig. 11 (same specimen as that described on page 11).

It appears from RUSCONI's figure that the specimen ("Tipo No. 11250") described by him as "cranideo" of "*Culipagnostus chipiquensis* n. sp." and figured as "cranideo" of "?*Triplagnostus chipiquensis* n. sp." has no basal lobes, and, accordingly, it must be a pygidium. This view is confirmed by the fact that the present writer's material contains two pygidia, which agree in most respects with RUSCONI's figure; these pygidia have the same rounded outline, the same gradually tapering axis truncated by a border furrow and furnished with a well-defined, keel-shaped median tubercle, and crossed by a wide transverse furrow; RUSCONI's figure fails to show marginal spines and a pair of pits in the wide transverse depression crossing the axis; in other respects the pygidia agree so well with the figure mentioned that they are referred by the present writer to the same species; judging from the characters of the pygidia, especially those of the axis, it admits of no doubt whatever that this species belongs to the genus *Clavagnostus* HOWELL.

Description: Pygidium subquadrangular, with strongly curved lateral margins, a little wider than long, of low convexity. Axis of about the same width as pleural fields, gradually tapering, truncated posteriorly by border furrow, divided a short distance posterior to centre by a wide transverse depression containing a pair of almost circular pits, and bearing a keel-

shaped median node on crest of anterior half. Axial furrows wide and deeply impressed throughout. Border furrow narrow, deeply impressed. Border somewhat convex, narrow at sides, expanded posteriorly, and furnished with a pair of relatively long, slender, diverging marginal spines.

Dimensions: Holotype pygidium about 2 mm long (estimated) and about 2.4 mm wide.

Remarks: The pygidium of *Clavagnostus chipiquensis* and that of *C. repandus* (WESTERGÅRD) (the type species) differ from the other hitherto known species in having the axis truncated posteriorly by border furrow, and the former differs from the latter in having strongly curved lateral margins, longer marginal spines, and almost circular axial pits.

The pygidium from Cerrillo El Solitario described and figured by RUSCONI (1950 a) as "*Clavagnostus calensis* n. sp." ("Tipo 7592") disagrees with that of the type species in so many respects that it can hardly be accepted as a member of the genus *Clavagnostus*.

Genus *Diplagnostus* JAEKEL, 1909

Diplagnostus jarillensis RUSCONI, 1952?

Pl. 1, fig. 9.

Material: A cephalon.

Description: Cephalon a little wider than long, rounded subquadrate in outline, fairly convex. Axial furrows wide, deeply impressed. Glabella occupying about 0.66 of cephalic length and about 0.33 of width, with depressed anterior glabellar lobe defined by shallow transglabellar furrow, occupying about 0.25 of glabellar length; posterior part of glabella unfurrowed, parallel-sided, and highly elevated above anterior glabellar lobe and genae. Basal lobes relatively small, subequilateral. Genae separated anteriorly by wide, well-defined longitudinal preglabellar furrow extending to border furrow and continuing backwards into anterior portion of anterior glabellar lobe. Cephalic border narrow, moderately convex, defined by narrow, well impressed border furrow.

External surface smooth.

Dimensions: Cephalon about 1.6 mm long and about 1.7 mm wide.

Remarks: Two pygidia have been referred by RUSCONI to the genus *Diplagnostus* viz. *D. jarillensis* RUSCONI, 1952 ("Tipo 9539") from Cerrillo El Solitario ("Horizonte Villavicense") and *D. indianus* RUSCONI, 1955 ("Tipo 18618") from the Middle Cambrian of the San Isidro region west of the city

of Mendoza ("Horizonte Isidrense"). In *D. indianus* the broadly rounded posterior axial termination is calculated to call the generic reference into dispute. The pygidium of *D. jarillensis* agrees tolerably well with that of the type species, *D. planicauda* (TULLBERG). The above-described cephalon is tentatively referred to *D. jarillensis*. Before 1952 the genus was known from Scandinavia and Australia only. The Cephalon of *D. jarillensis* differs from that of Scandinavian species in having much smaller basal lobes and a wide, deeply impressed longitudinal preglabellar furrow extending to the border furrow, and it is distinguished from the Australian *D. humilis* (WHITEHOUSE) by its wider longitudinal preglabellar furrow and rounded subquadrate cephalic outline.

Genus *Kormagnostus* RESSER, 1938

In RESSER's diagnosis this genus is "characterized by the absence of an anterior glabellar lobe" and by having "a wide pygidial axis which expands slightly rearward and extends to the marginal furrow. Pygidial border rather wide and slightly thickened". It may be added that the pygidial axis is prominent and with faintly indicated, almost effaced segmentation, and that the pygidial border is provided with a pair of marginal spines. LOCHMAN (1940) is of opinion that "*Kormagnostus* is a clear-cut, distinctive genus", and that is correct when combined cephalic and pygidial characters are taken into consideration, but it deserves notice that the cephalon of *Kormagnostus* displays a striking resemblance to that of *Hypagnostus* JAEKEL so as to make determination of isolated cephalia very problematic; accordingly, the generic reference of the isolated cephalon described in the following is open to doubt.

Kormagnostus? propinquus n. sp.

Pl. 1, fig. 10

Material: A fragmentary cephalon.

Description: Cephalon fairly convex, slightly wider than long (estimated), considerably decreasing in width posteriorly. Axial furrows narrow and very shallow. Posterior glabellar lobe without traces of segmentation, occupying about 0.5 of cephalic length (estimated) and about 0.4 of width, slightly convex, somewhat tapering, abruptly truncated anteriorly by narrow, very shallow transverse furrow, with a very small, oblong median tubercle

in front of lobal centre. Basal lobes small, triangular, slightly convex. Genae strongly convex at sides, falling rather steeply to wide, shallow border furrow. Border of medium width, slightly convex.

External surface smooth.

Dimensions: Cephalon about 2.5 mm long (estimated) and about 2.7 mm wide.

Remarks: As mentioned above, the writer is of opinion that isolated cephalae of *Kormagnostus* can hardly be distinguished from those of *Hypagnostus*. It is therefore necessary to compare the cephalon of *Kormagnostus? propinquus* with those referred by RUSCONI to *Hypagnostus* viz. *H. andinus* RUSCONI, 1955 ("Tipo 18610") from the Middle Cambrian of the San Isidro region ("Horizonte Isidrense"), *H. huilichensis* RUSCONI, 1955 ("Tipo 18447") from the Upper Cambrian of the San Isidro region, and *H. mollensis* RUSCONI, 1952 ("Tipo 9574") from the Cambrian of Cerrillo El Solitario. *Kormagnostus? propinquus* differs from *H. andinus* in having larger glabella and different cephalic outline, and from *H. huilichensis* in having shorter, more tapering glabella with unfurrowed posterior lobe, indistinctly defined basal lobes, and different cephalic outline; with regard to cephalic outline it agrees fairly well with *H. mollensis*, but it is clearly distinct from that species by its tapering glabella and narrower cephalic border. It is much more similar to *Kormagnostus esterius* LOCHMAN, 1940, from the Bonneterre dolomite of southeastern Missouri and the Pilgrim formation of Montana, from which it is distinguished by its indistinctly defined basal lobes and by the lack of an indicated anterior glabellar lobe. It is impossible for the time being to decide whether one or the other of the two pygidia described and figured by RUSCONI (1954) as "*Kormagnostus cuchillensis* n. sp." and "*Kormagnostus lanceolatus* n. sp.", both from Cambrian strata near San Isidro, should be combined with the cephalon of *K.? propinquus* or not.

Genus *Oedorhachis* RESSER, 1938

Original diagnosis: "Agnostid with a normal cranidium, which possibly lacks a median furrow in typical species. The pygidium has a long rhachis, extending almost or altogether to the marginal furrow; rear lobe greatly expanded in exfoliated specimens, but poorly impressed on the outer test."

RESSER referred six new species to his new genus viz. *O. typicalis* (type species), *O. ulrichi*, *O. boltonensis*, *O. tennesseeensis*, *O. mesteri*, and *O. green-dalensis*. It appears from RESSER's figures that these species represent two different groups, one characterized by wide, subquadrate pygidium with the expanded posterior axial portion well-defined by deeply impressed axial

furrows, the other characterized by a more rounded pygidial outline and by having the expanded posterior axial portion indistinctly defined by more or less effaced axial furrows. The latter group of species seems to agree very well with the general conception of *Pseudagnostus* JAEKEL, 1909, and the species in question may belong to this genus; one of the species (*Oedorhachis mesleri*) has already been referred by LOCHMAN (1940) to *Pseudagnostus*. The other group, which contains *O. typicalis* and *O. ulrichi*, seems to constitute a well-founded genus.

Oedorhachis australis n. sp.

Pl. 1, fig. 8

Material: An exfoliated pygidium.

Description: Pygidium subquadrangular, wider than long, moderately convex. Axial furrows well-defined. Axis occupying about 0.8 of pygidial length and about 0.4 of width, broadly rounded posteriorly, extending to border furrow, divided by indistinctly defined furrows into 2 axial rings and an expanded posterior portion; second axial ring crossed by narrow, well-defined median keel extending from posterior part of first axial ring to anterior part of posterior axial lobe. Pleural fields tapering posteriorly, separated by confluent axial and border furrows. Border furrow very wide. Border narrow at sides, somewhat expanded at the rear and divided by shallow, transverse depression in front of which it is raised into a sharp ridge; marginal spines extremely small, situated opposite axial termination.

Surface markings not observed.

Dimensions: Length of pygidium 3.4 mm, width 5 mm.

Remarks: *Oedorhachis australis* seems to be very closely related to *O. typicalis* RESSER (type species) and *O. ulrichi* RESSER; it differs, however, from these species in its less abruptly expanding posterior axial lobe and in having the expanded posterior border divided by a long, transverse depression extending from one marginal spine to the other; *O. ulrichi* shows a tendency to develop a similar, but much shorter transverse depression on the expanded posterior border.

Genus *Peronopsis* HAWLE & CORDA, 1847

Peronopsis ultima n. sp.

Pl. 1, fig. 13

Material: A single pygidium.

Description: Pygidium moderately convex, slightly longer than wide,

tending to become subquadrangular, with very narrow, slightly convex border, and fairly wide, shallow border furrow. Axis occupying about 0.7 of pygidial length and about 0.3 of width, defined by fairly wide, deeply impressed axial furrows, moderately elevated above pleural fields, lanceolate, with acute posterior termination, quite effaced segmentation, and almost effaced elongate median tubercle situated a little behind axial centre. Pleural fields evenly sloping, slightly increasing in width posteriorly, separated by wide, relatively deep longitudinal furrow.

Surface smooth.

Dimensions:

Length of pygidium	2.0 mm
Width - - -	1.8 -
Length - axis	1.3 -
Width - - at anterior end	0.7 -

Remarks: The following combination of characters serve to distinguish this species from other species of the genus *Peronopsis*: Very short axis, almost effaced median axial tubercle, wide longitudinal furrow, and extremely narrow border of almost even width throughout. It is possible that the cephalia provisionally referred to *Baltagnostus hospitus* n. sp. (p. 7) may belong to *Peronopsis ultima*.

Genus *Phoidagnostus* WHITEHOUSE, 1936

Phoidagnostus solitariensis (RUSCONI, 1950)

Pl. 1, fig. 15

1950. *Gallagnostus solitariensis* RUSCONI, Rev. Mus. Hist. Nat. Mendoza, Vol. 4, p. 72, p. 83, figs. 2 a-b.

Material: An almost complete pygidium and a fragmentary natural cast of external pygidial surface.

Description: Pygidium practically as long as wide, subcircular in outline. Axial region and pleural fields strongly convex, forming an almost hemispheric main body with a small median tubercle half-way between centre and anterior margin. Border furrow wide, extremely shallow. Border fairly wide, almost flat, horizontal.

Surface smooth.

Dimensions: Length 3.5 mm, width 3.6 mm.

Remarks: The pygidium at hand agrees very well with the specimen described and figured by RUSCONI as "cranideo", and it is referred by the

present writer to the same species; there is a slight difference with regard to the location of the median tubercle, which in RUSCONI's drawing is placed a little closer to the anterior margin. The highly convex, almost hemispheric pygidial main body, the indistinctly defined border furrow, and the flat, horizontal border constitute the most conspicuous distinguishing characters of this species.

With regard to the generic reference it should be noticed that pygidia of *Phoidagnostus* are very similar to those of *Gallagnostus*; species of the latter have a sharply marked pygidial border furrow, whereas species of the former (as far as is known) have a moderately developed, less distinct border furrow. RUSCONI's species in this respect agrees better with *Phoidagnostus* than with *Gallagnostus*.

Genus *Stigmagnostus* n. g.

(Type species: ?*Tomagnostus canotensis* RUSCONI, 1951)

Diagnosis: Genus displaying the general characters of *Peronopsis* HAWLE & CORDA, 1847, but distinct from it by having a coarsely pitted pygidium. *Derivatio nominis*: *στίγμα* = *Stigma* (brand).

Remarks: This genus is known from the Cambrian of Cerrillo El Solitario only. In RUSCONI's type specimen ("Tipo 11228"), described and figured as "cranideo", neither anterior glabellar lobe nor basal lobes are shown; accordingly, the specimen in question must be a pygidium. As far as is known, coarsely pitted pygidia have not been observed in other genera of the Agnostida. *Stigmagnostus* should probably be placed in the subfamily Peronopsinae. The type species appears to be the only known representative of this new genus.

Stigmagnostus canotensis (RUSCONI, 1951)

Pl. 1, figs. 11—12

1951. ?*Tomagnostus canotensis* RUSCONI, Rev. Mus. Hist. Nat. Mendoza, Vol. 5, p. 14; p. 26, fig. 29.

Original description: "Cranideo¹ de 2.6 mm de longitud por 2.2 mm de ancho (fig. 29). Forma elíptica. El céphalo es sumamente alargado y estrecho, y adelante hay una leve bipartición que parecería corresponder a la glabella, pero que carece del surco transversal que la divide. La concha

¹ See the above remarks in connection with the generic diagnosis.

es relativamente chata y está constituida por doble hilera de vacuidades o pozuelos algo alargados y dispuestos transversalmente. En derredor del limbo hay una pestaña o borde angosto."

Material: A somewhat fragmentary pygidium and two associated cephalae.

Description: Cephalon inconsiderably wider than long, moderately convex, with almost evenly rounded antero-lateral outline. Glabella occupying about 0.7 of cephalic length and about 0.25 of width, defined by fairly wide, well impressed axial furrows; anterior glabellar lobe semicircular in outline, depressed, defined posteriorly by well impressed transverse furrow; Posterior glabellar lobe more convex than anterior lobe. Basal lobes well-defined, approximately equilateral. Genae confluent, of almost even width throughout, gently sloping anteriorly and laterally. Border furrow relatively wide, well impressed. Border narrow, fairly convex.

Pygidium of about same shape as cephalon. Axis occupying about 0.64 of pygidial length and 0.2 of width, defined by wide, deeply impressed axial furrows, lanceolate, sharply pointed posteriorly, moderately convex, inconsiderably elevated above pleural fields, and without perceptible annulation; median tubercle not observed. Pleural fields of almost uniform width throughout, gently sloping, separated posteriorly by long well-defined longitudinal furrow. Border furrow relatively wide, well impressed. Border narrow, fairly convex, without marginal spines.

Surface of genae and pleural fields coarsely pitted.

Dimensions: Figured cephalon 1.85 mm long and 1.95 mm wide. Figured pygidium 2.8 mm long (estimated) and 3 mm wide.

Remarks: Judging from Rusconi's coarse drawing the type specimen is narrower than the pygidium figured here as Pl. 1, fig. 12; this may be due to the folding of the Cambrian rocks of Cerrillo El Solitario, which has resulted in deformation of some of the fossils; both specimens, however, have very narrow, lanceolate, posteriorly pointed, unfurrowed axis, long, well-defined postaxial longitudinal furrow, narrow border, and coarsely pitted pleural fields, and, accordingly, they are regarded as conspecific.

Order **PTYCHOPARIIDA** RICHTER, 1932Suborder **Ptychopariina** RICHTER, 1932Superfamily **CREPICEPHALACEA** KOBAYASHI, 1935Family **TRICREPICEPHALIDAE** PALMER, 1954Genus *Prometeoraspis* n. sp.

(Type species: *Prometeoraspis canotensis* n. sp.)

The Family Tricrepicephalidae was established by PALMER (1954) to cover the genera *Tricrepicephalus* KOBAYASHI, 1935 and *Meteoraspis* RESSER, 1935. Both genera are characterized by having ptychoparoid cranidia with deep axial, occipital, and border furrows, 2 or 3 pits in border furrow, and pygidia with a pair of more or less backward-directed spines.

The material from Cerrillo El Solitario contains a single cranidium, which shows the essential characters of *Meteoraspis* with the exception of the pits in the border furrow and the excessive upturning and convexity of the anterior border. In spite of the fact that the mentioned pits are indistinctly defined in some species of *Meteoraspis*, the writer is inclined to regard the complete absence of pits in the border furrow as a character of generic value.

Diagnosis: Tricrepicephalid trilobites with cranidium like that of *Meteoraspis* but differing from it by lack of pits in the border furrow and by having moderately convex, not upturned anterior border.

Prometeoraspis canotensis n. sp.

Pl. 1, figs. 16—17

Material: A fragmentary, slightly deformed cranidium.

Description: Cranidium oblong in shape, considerably curved on a transverse axis. Glabella defined by deeply impressed axial furrows, occupying about 0.83 of cephalic length and about 0.3 of width, about 1.4 times as long as wide, moderately convex, moderately tapering, almost evenly rounded in front, with 3 indistinctly defined anterior pairs of lateral glabellar furrows, followed by four well impressed, symmetrically arranged pits representing a strongly oblique posterior pair. Occipital furrow very broad, deeply impressed at sides, shallow at axial line. Occipital ring fairly convex, apparently with its greatest width (sag.) at the median line of the cranidium. Anterior and palpebral areas of fixigenae very narrow, the former strongly

sloping towards the border furrow and the anterior sections of the facial suture, the latter highly convex, elevated almost to the level of the crest of the glabella; posterior areas of about the same width (trans.) as the glabella, tongue-shaped, with bluntly terminating, strongly sloping extremities, divided by the broad, shallow posterior border furrow into subequal parts. Eye-ridges obscure. Palpebral lobes slightly curved, fairly prominent, extending backwards from a point opposite the second pair of lateral glabellar furrows to terminate well beyond the posterior pair of lateral glabellar furrows. Anterior sections of facial suture slightly converging from eyes to anterior border; posterior sections running almost directly outwards for the greater part of their length, then forming even backward curves. Preglabellar field extremely short. Anterior border furrow narrow, evenly curved. Anterior border fairly wide, moderately arched in longitudinal and transverse profile. External surface smooth to the naked eye, but a very delicate granulation is revealed by magnification $\times 20$.

Dimensions:

Length of cranidium (estimated)	5.0 mm
Width - - - at anterior end of palpebral lobes	3.3 -
- - - - posterior border	7.4 -
Maximum distance between eyes	4.7 -
Length of glabella (exclusive of occipital ring)	3.3 -
Width - - - at base	2.7 -
- - - - anterior end of palpebral lobes	2.0 -

Remarks: The type species described above seems to be the only known representative of the genus *Prometeoraspis*.

Superfamily ASAPHISCACEA RAYMOND, 1924

Family ASAPHISCIDAE RAYMOND, 1924

Subfamily ASAPHISCINAE RAYMOND, 1924

Genus *Williamsina* n. g.

(Type species: *Williamsina cortesii* n. sp.)

Four species from Cerrillo El Solitario are referred to this new genus, which displays considerable resemblance to the genera *Blountia* WALCOTT, 1916, and *Blainia* WALCOTT, 1916, of the Asaphiscinae.

Diagnosis: Asaphiscinae with relatively large, approximately semicir-

cular, somewhat depressed palpebral lobes situated opposite the glabellar centre, and furthermore characterized by lack of a palpebral furrow and a palpebral rim. Associated pygidium short, wide, indistinctly segmented, with tapering axis of about 6 rings and flat or slightly concave border. Hypostome, thorax, and ventral parts unknown.

Remarks: *Williamsina* differs from *Blountia* in having larger, strongly curved, depressed palpebral lobes without palpebral furrow and palpebral rim and tongue-shaped lateral extremities of fixigenae, and it is distinguished from *Blainia* by the mentioned characters of its palpebral lobes and by the more diverging course of the anterior sections of its facial suture between eyes and anterior border.

Williamsina cortesi n. sp.

Pl. 1, figs. 19—24

Material: Thirty cranidia, five librigenae, and fourteen pygidia.

Description: Cranidium 1.4 times as wide as long, considerably arched longitudinally and transversally. Glabella well-defined by narrow axial furrows, occupying 0.54 of cranidial length and 0.4 of width, as wide as long, considerably tapering, evenly rounded in front, separated from the anterior border by a well-developed preglabellar field, fairly convex, well elevated above palpebral areas of fixigenae, with three pairs of oblique, almost completely effaced lateral glabellar furrows. Occipital furrow narrow, deeply impressed at sides, very shallow at axial line. Occipital ring narrow (sag.), slightly convex. Anterior and palpebral areas of fixigenae moderately wide; eye-ridges practically effaced; palpebral lobes relatively large, approximately semicircular, depressed, without palpebral furrow and palpebral rim, situated opposite glabellar centre; posterior areas tongue-shaped, strongly sloping, divided by fairly broad, well impressed posterior border furrow into subequal portions. Anterior sections of facial suture considerably diverging from eyes to anterior border furrow, then strongly converging to cephalic margin; posterior sections directed outward and slightly backwards, paralleling posterior cephalic margin for a considerable distance, then curving evenly backwards to cut posterior border very close to genal angles. Anterior border furrow narrow and shallow, gently curved, paralleling anterior cranidial margin for a considerable distance. Anterior border fairly wide, flat, horizontal to slightly upturned. Librigenae of medium width, moderately convex, with narrow, shallow lateral border furrow,

fairly wide, flat lateral border, and well-developed, wide, rapidly tapering genal spine in direct continuation of lateral border.

Pygidium about 1.8 times as wide as long, approximately semicircular in outline, moderately convex. Axis defined by wide, shallow axial furrows, about twice as long as wide, rapidly tapering, extending to posterior border furrow, occupying about 0.77 of pygidial length and about 0.24 of width, fairly convex, divided by almost effaced transverse furrows into about 6 axial rings and a small terminal portion. Pleural fields smooth or with extremely faint indications of segmentation. Border furrow very shallow. Border fairly wide, slightly concave, crossed by indistinctly defined post-axial ridge.

Surface of cranidium, librigenae and pygidium smooth.

Dimensions:

Length of cranidium (holotype).....	5.5 mm
Width - - - - - at anterior border furrow	4.5 -
- - - - - - - centre of palpebral lobes ...	5.0 -
- - - - - - - posterior border	7.7 -
Length - glabella - (exclusive of occipital ring)....	3.0 -
Width - - - - - at base.....	3.0 -
- - - - - - - anterior end of palpebral lobes	2.0 -
Length - figured pygidium	3.5 -
Width - - - - -	6.2 -
Length - pygidial axis	2.7 -
Width - - - - -	1.5 -

Remarks: *Williamsina cortesi* is the dominant species in the material at hand.

Williamsina harringtoni n. sp.

Pl. 1, fig. 29

Material: A pygidium.

Description: Pygidium about 1.7 times as wide as long, approximately semicircular in outline, moderately convex. Axis defined by narrow, shallow axial furrows, about twice as long as wide, moderately tapering, extending a little beyond posterior border furrow, occupying about 0.9 of pygidial length and about 0.18 of width, fairly convex, divided by almost effaced transverse furrows into 5 axial rings and a small terminal portion. Segmentation of pleural fields almost completely effaced. Border furrow shallow but fairly well defined. Border narrow and flat laterally, gradually in-

creasing in width toward axis and becoming slightly concave. Surface smooth.

Dimensions:

Length of pygidium (holotype)	.....	2.65	mm
Width - - -	.....	4.65	-
Length - axis	.....	2.35	-
Width - - -	.....	1.18	-

Remarks: The pygidium of this species is easily distinguished from that of *Williamsina cortesi* (the type species) by its less tapering axis and the increasing width of the border towards the axis.

Williamsina mikkelsenii n. sp.

Pl. 1, figs. 25—28

Material: A cranidium (holotype) and a pygidium.

Description: Cranidium about 1.4 times as wide as long, slightly arched longitudinally and transversally. Glabella well-defined by narrow axial furrows, occupying 0.6 of cranidial length and 0.3 of width, 1.22 times as wide as long, somewhat tapering, evenly rounded in front, separated from anterior border by well-developed preglabellar field, moderately convex, slightly elevated above palpebral areas of fixigenae, with two pairs of distinctly defined, oblique lateral glabellar furrows. Occipital ring narrow (sag.), slightly convex. Occipital furrow narrow, distinctly marked throughout. Anterior and palpebral areas of fixigenae moderately wide; eye-ridges faintly marked, fairly oblique; palpebral lobes fragmentary, probably like those of the type species (p. 19); posterior areas tongue-shaped, moderately sloping, divided by fairly broad, well impressed posterior border furrow into subequal portions. Anterior sections of facial suture strongly diverging from eyes to anterior border furrow, then strongly converging to cephalic margin; posterior sections directed outwards, paralleling posterior cephalic margin for a considerable distance, then curving evenly backwards. Anterior border furrow fairly wide, distinctly marked, paralleling anterior cranidial margin for a considerable distance. Anterior border fairly wide, almost flat.

Pygidium about twice as wide as long, approximately semicircular in outline, almost flat. Axis defined by shallow axial furrows, about twice as long as wide, moderately convex, extending to posterior border furrow, occupying about 0.8 of pygidial length and about 0.2 of width, divided by almost effaced transverse furrows into 5 (6?) axial rings and a small rounded

terminal portion followed by very short postaxial ridge. Segmentation of pleural fields almost completely effaced. Border furrow very shallow. Border fairly wide, approximately horizontal, slightly concave.

Surface of cranidium and pygidium smooth.

Dimensions:

Length of cranidium	4.5 mm
Width - - at anterior border furrow	4.2 -
- - - - centre of palpebral lobes	4.2 -
- - - - posterior border	6.2 -
Length - glabella (exclusive of occipital ring)	2.7 -
Width - - at base	2.2 -
- - - - anterior end of palpebral lobes	1.7 -
Length - pygidium	3.7 -
Width - -	7.7 -
Length of pygidial axis	3.0 -
Width - - -	1.5 -

Remarks: This species differs from *Williamsina cortesi* n. sp. (the type species (p. 19)) in having a less arched cranidium with a less tapering glabella, better defined lateral glabellar furrows, almost straight posterior fixigenal margin, more diverging anterior sections of the facial suture, a more curved anterior border furrow, and a wider, almost flat pygidium with a less tapering axis and approximately horizontal border.

Williamsina ornata n. sp.

Pl. 2, fig. 1; Pl. 3, fig. 1

Material: Six more or less fragmentary pygidia.

Description: Pygidium 1.54 to 1.65 times as wide as long, moderately convex, with evenly rounded postero-lateral outline. Axis defined by shallow axial furrows, 1.84 to more than twice as long as wide, moderately tapering, prominent, extending to posterior border furrow or slightly encroaching on posterior border, occupying 0.63 to about 0.8 of pygidial length and 0.21 to 0.27 of width, divided by almost effaced transverse furrows into 5—6 axial rings and a small terminal portion. Segmentation of pleural fields indicated by raised segmental edges. Border furrow shallow, indistinctly marked. Border fairly wide, slightly concave, more or less sloping, covered with more or less distinctly marked network formed by raised, inosculating lines (more distinctly marked in the holotype than in the other specimens).

Dimensions:

	I	II	III	IV (holotype)
Length of pygidium	3.1	— 3.2	— 4.6	— 5.3 mm
Width -	4.8	— 5.3	— 7.4	— 8.4 -
Length - axis	2.4	— 2.5	— 3.9	— 4.3 -
Width - -	1.3	— 1.3	— 1.6	— 2.3 -

Remarks: The raised segmental edges of the pleural fields and the surface markings of the pygidial border serve to distinguish *Williamsina ornata* from other species.

Superfamily SOLENOPLEURACEA ANGELIN, 1854

Family LONCHOCEPHALIDAE HUPÉ, 1953

Genus *Talbotinella* n. g.

(Type species: *Talbotinella communis* n. sp.)

Diagnosis: Lonchocephalidae with relatively short, strongly tapering glabella, four pairs of strongly oblique lateral glabellar furrows; first pair developed as shallow pits remote from axial furrows; second pair broad and shallow, almost in contact with axial furrows; third pair better defined, bifurcating distally so as to circumscribe an extraordinary, usually somewhat swollen lateral lobe; fourth pair almost in contact with axial furrows, indistinctly defined in some specimens or even effaced. Occipital furrow broad, deeply impressed at sides. Occipital ring narrow (sag.) and slightly convex (sag.), with well developed occipital spine in typical species. Glabella usually separated from anterior border by fairly ample preglabellar field. Anterior and palpebral areas of fixigenae narrow; posterior areas slightly narrower than base of glabella, with broad deeply impressed posterior border furrow; posterior border convex; eye-ridges more or less indistinctly defined, oblique; palpebral lobes small strongly curved, situated moderately in advance of glabellar centre. Anterior sections of facial suture subparallel or slightly diverging from eyes to anterior border; posterior sections extending obliquely backwards to cross posterior border very close to genal angles. Anterior border furrow narrow, well impressed. Anterior border relatively narrow, moderately convex. Librigenae moderately wide, evenly arched, with flat lateral border and well developed, slender, obliquely backward-directed genal spine almost in continuation of lateral border.

Hypostome and other ventral parts unknown.

Thorax unknown.

Pygidium of type species short, very wide, subelliptic in outline, moderately convex, with prominent, slightly tapering axis consisting of three rings and a rounded terminal portion extending to indistinctly defined, concave border; pleural fields and border with well marked pleural furrows and interpleural grooves.

External surface of cranidium and librigenae densely covered with minute granulae, distinctly marked on glabella and occipital ring and indistinct or even effaced on palpebral and posterior areas of fixigenae and on librigenae; preglabellar field, anterior areas of fixigenae, and librigenae further marked by extremely delicate, raised, inosculating lines radiating from glabella, eye-ridges, and eyes.

Remarks: *Talbotinella* recalls the genus *Talbotina* LOCHMAN, especially when compared with *Talbotina jeweli* LOCHMAN (LOCHMAN & DUNCAN, 1944, p. 130, pl. 12, figs. 6—12). The genera have several features in common, such as outline, convexity, and surface markings of cranidium, shape of pygidial axis, pleural fields and border of pygidium with well marked pleural furrows and interpleural grooves. *Talbotinella*, however, differs from *Talbotina* in having more tapering glabella, a pair of extraordinary lateral glabellar lobes defined by distal bifurcation of third pair of lateral glabellar furrows, occipital ring narrower (trans.) than base of glabella, ampler preglabellar field, less convex anterior cranidial border, smaller, strongly curved palpebral lobes, and shorter and wider pygidium.

Talbotinella communis n. sp.

Pl. 2, figs. 2—8; Pl. 3, fig. 2

Material: Eight cranidia, a librigena, and two associated pygidia.

Description: Cranidium 1.3 times as wide as long exclusive of occipital spine; its anterior part moderately arched longitudinally and transversally, posterior part considerably arched transversally. Glabella well defined by narrow axial furrows, occupying 0.56 of cranidial length and 0.45 of width, almost as wide as long, strongly tapering, subtriangular in outline, evenly and narrowly rounded in front, separated from anterior border by well-developed preglabellar field, moderately convex, yet well elevated above palpebral areas of fixigenae (for description of lateral glabellar furrows see generic diagnosis p. 23). Occipital furrow very broad, deeply impressed at sides, shallow at axial line. Occipital ring narrow (sag.), much narrower (trans.) than base of glabella, with well-developed occipital

spine of unknown length. Anterior and palpebral areas of fixigenae relatively narrow; posterior areas moderately wide, subtriangular, strongly sloping; palpebral lobes very small, strongly curved, situated moderately in advance of glabellar centre; eye-ridges faintly marked, oblique; posterior border furrow broad, deeply impressed; posterior border convex, extending obliquely backwards from axial furrows. Anterior border furrow narrow, well impressed, gently curved. Anterior border relatively narrow, moderately convex. Anterior sections of facial suture slightly diverging from eyes to anterior border; posterior sections curving gently outwards and backwards to cross posterior border very close to genal angles. Librigenae of medium width, evenly arched, with narrow, flat lateral border slightly increasing in width posteriorly; genal spines well-developed, slender, obliquely backward-directed, practically in continuation of lateral border.

For pygidium and surface markings see generic diagnosis p. 24.

Dimensions:

	I (holotype) II	
Length of cranium (exclusive of occipital spine) ..	10.2 ...	? mm
Width - - - at anterior border furrow	7.7 ...	8.7 -
- - - - centre of palpebral lobes ...	8.7 ...	9.7 -
- - - - posterior border	13.2 ...	14.2 -
Length of glabella (exclusive of occipital ring)	6.0 ...	6.3 -
Width - - - at base	5.7 ...	6.0 -
- - - - anterior end of palpebral lobes	3.7 ...	4.0 -
Length - figured pygidium ...	3.1 mm	
Width - - -	6.2 -	
Length - pygidial axis	2.6 -	
Width - - -	2.2 -	

Remarks: *Talbotinella communis* is distinguished from other species of this new genus by the narrowly rounded front of its glabella and the strongly oblique backward course of the posterior cranial margin from the axial furrows to the facial suture.

Talbotinella leanzai n. sp.

Pl. 2, figs. 9—12

Material: A cranium and a librigena.

Description: Cranium about 1.7 times as wide as long exclusive of occipital spine; its anterior part moderately arched longitudinally and transversally, posterior part considerably arched transversally. Glabella

defined by narrow, well impressed axial furrows, occupying about 0.7 of cranial length and 0.38 of width, a little wider than long, strongly tapering, subtriangular in outline, evenly and broadly rounded in front, separated from anterior border by well-developed preglabellar field, moderately convex, yet well elevated above palpebral areas of fixigenae, (for description of lateral glabellar furrows see generic diagnosis p. 23). Occipital furrow broad, very deeply impressed at sides. Occipital ring narrow (sag.), a little narrower (trans.) than base of glabella. Anterior and palpebral areas of fixigenae relatively narrow; posterior areas of medium width, subtriangular, strongly sloping; eye-ridges very indistinctly defined, oblique; palpebral lobes small, strongly curved, situated moderately in advance of glabellar centre; posterior border furrow broad, deeply impressed; posterior border convex, extending almost directly outwards from axial furrows. Anterior border furrow narrow, well impressed, gently curved. Anterior border narrow, moderately convex. Anterior sections of facial suture almost parallel between eyes and anterior border; posterior sections extending outwards and backwards to cross posterior border at genal angles. Librigenae of medium width, evenly arched, with flat lateral border; genal spines well-developed, slender, obliquely backward-directed, not quite in continuation of lateral border.

For description of surface markings see generic diagnosis p. 24.

Dimensions of cranidium (holotype):

Length of cranidium (exclusive of occipital spine)	6.3 mm
Width - - - at anterior border furrow	4.8 -
- - - - centre of palpebral lobes	5.7 -
- - - - posterior border	10.0 -
Length - glabella (exclusive of occipital ring)	3.7 -
Width - - - at base	3.8 -
- - - - anterior end of palpebral lobes	2.3 -

Remarks: *Talbotinella leanzai* appears to be very closely related to *T. communis* (the type species); the former differs from the latter in having a wider glabella with broadly rounded front, narrower, more convex anterior border, subparallel course of anterior sections of facial suture between eyes and anterior border, posterior sections crossing posterior border at genal angles, and posterior cephalic border almost perpendicular to cephalic median line. The associated librigena differs from that of the type species in having a slightly wider lateral border, and the genal spine not quite in continuation of the lateral border.

Talbotinella rusconii n. sp.

Pl. 2, figs. 13—15

Material: A somewhat fragmentary cranidium.

Description: Cranidium of unknown width (postero-lateral extremities not preserved); its anterior part considerably arched longitudinally and moderately arched transversally. Glabella defined by narrow, well impressed axial furrows, occupying about 0.7 of cranidial length, a little longer than wide, moderately tapering, evenly rounded in front, separated from anterior border by short preglabellar field, moderately convex, yet well elevated above palpebral areas of fixigenae (for description of lateral glabellar furrows see generic diagnosis p. 23). Occipital furrow broad, very deeply impressed at sides, shallow at axial line. Occipital ring narrow (sag.), much narrower (trans.) than base of glabella, provided with small median node. Anterior and palpebral areas of fixigenae relatively narrow; eye-ridges well-defined, oblique; palpebral lobes small, moderately curved, situated a little in front of glabellar centre. Anterior border furrow narrow and shallow, rectilinear. Anterior border relatively narrow, almost flat. Anterior sections of facial suture subparallel between eyes and anterior border.

For description of surface markings see generic diagnosis p. 24.

Dimensions:

Length of cranidium	.....	9.3 mm
Width	- - at anterior border furrow.....	7.7 -
-	- - - centre of palpebral lobes.....	9.0 -
-	- - - posterior border.....	? -
Length	- glabella (exclusive of occipital ring)	6.3 -
Width	- - at base	5.5 -
-	- - - anterior end of palpebral lobes	3.3 -

Remarks: *Talbotinella rusconii* is easily distinguished from the two preceding species by its narrower, less tapering glabella, short preglabellar field, well marked eye-ridges, moderately curved palpebral lobes, rectilinear anterior border furrow, almost perfectly flat anterior border, and lack of occipital spine.

Superfamily NORWOODIACEA WALCOTT, 1916

Family MENOMONIIDAE WALCOTT, 1916

Genus *Bolaspidella* RESSER, 1937*Bolaspidella lucieae* n. sp.

Pl. 2, figs. 16—17

Material: Five cranidia and a librigena.

Description: Cranidium almost twice as wide as long. Glabella well defined by deeply impressed axial furrows, occupying about 0.5 of cranial length and 0.2 of width, 1.3 times as long as wide, moderately tapering, somewhat truncated in front, separated from anterior border by well-developed preglabellar field, fairly convex, with three pairs of very shallow, indistinctly defined marginal impressions representing lateral glabellar furrows. Occipital furrow well impressed, narrow at axial line, broad at sides. Occipital ring wide at axial line, strongly tapering at sides, with a small median node. Anterior and palpebral areas of fixigenae moderately wide, the latter elevated above crest of glabella and sloping off rather steeply towards axial furrows; posterior areas very wide, with strongly sloping lateral extremities; eye-ridges indistinctly defined, perpendicular to axis; palpebral lobes small, situated well in advance of glabellar centre; posterior border furrow broad, deeply impressed; posterior border convex, slightly backward-directed near posterior termination of facial suture. Anterior border furrow fairly broad, well impressed, gently curved. Anterior border of medium width, convex. Anterior sections of facial suture parallel or nearly so between eyes and anterior border; posterior sections curving outwards from eyes, then backwards to cross posterior border very close to genal angles. Librigenae wide, with moderately and evenly arched proximal area, well impressed lateral border furrow, and convex lateral border becoming almost flat and increasingly wide near genal angles; genal spines well-developed, flat, backward-directed, in continuation of the lateral border, rapidly tapering.

External surface of cranidium and librigenae marked by a relatively small number of scattered tubercles and more numerous, irregularly spaced granules.

Dimensions of cranidium (holotype):

Length of cranidium	.....	1.8	mm
Width	- - at anterior border furrow	.....	1.47 -
- - -	- - - centre of palpebral lobes (estimated)	.	1.67 -

Width of cranidium at posterior border	3.35 mm
Length - glabella (exclusive of occipital ring).....	0.9 -
Width - - at base	0.66 -
- - - - anterior end of palpebral lobes	0.53 -

Remarks: This species is readily distinguished from the hitherto known species of the genus *Bolaspidella* by the following combination of characters: Almost parallel-sided glabella, very shallow, indistinctly defined lateral glabellar furrows, and broad, curved anterior border furrow. The librigena figured by HOWELL (1937, pl. 5, fig. 34) as *Champlainia rectimargo* shows striking resemblance to that of *Bolaspidella lucieae*; accordingly, the present writer is of opinion that the librigena mentioned should be referred to the genus *Bolaspidella*.

Incertae Sedis

Genus *Canotaspis* n. g.

(Type species: *Canotaspis aliena* n. sp.)

This genus is known from the cranidium alone.

Diagnosis: Cranidium approximately semicircular in outline, almost evenly arched longitudinally and transversally, with unfurrowed, slightly tapering, anteriorly truncated glabella, narrow (sag.) occipital ring, short preglabellar field, wide fixigenae, small palpebral lobes situated well in front of the glabellar centre, evenly curved anterior border furrow, narrow, flat anterior border, and smooth external surface.

Remarks: The affinities of this trilobite are obscure. The general shape is much the same as in *Aposolenopleura? brevifrons* RASSETTI (1944, p. 239, pl. 36, fig. 46), which is "not quite typical of the genus"; *Canotaspis aliena*, however, differs from RASSETTI'S species in having wider fixigenae and a curved anterior border furrow.

Canotaspis aliena n. sp.

Pl. 2, figs. 21—22

Material: An almost complete cranidium.

Description: Cranidium approximately semicircular in outline, almost evenly arched longitudinally and transversally, about 1.8 times as wide as long. Glabella well-defined by narrow, moderately impressed axial furrows, occupying about 0.7 of cranidial length and 0.33 of width, almost

as wide as long, slightly tapering, truncated in front, unfurrowed, separated from anterior border by a short preglabellar field, moderately convex, somewhat elevated above level of the fixigenae. Occipital furrow narrow, well impressed. Occipital ring narrow (sag.). Anterior and palpebral areas of fixigenae relatively wide; posterior areas of medium width; eye-ridges effaced; palpebral lobes small, situated well in front of the glabellar centre; posterior border furrow narrow and deeply impressed near axial furrows, becoming gradually wide and shallow towards the facial suture; posterior border narrow, convex. Anterior border furrow narrow and shallow, gently curved. Anterior border narrow and flat. Facial suture almost evenly curved from anterior to posterior cephalic margin.

External surface smooth.

Dimensions:

Length of cranium	.....	13.0 mm
Width - -	at anterior border furrow	15.0 -
- - -	- centre of palpebral lobes	19.0 -
- - -	- posterior border	24.0 -
Length -	glabella (exclusive of occipital ring)	9.0 -
Width - -	at base	8.0 -
- - -	- anterior end of palpebral lobes	5.5 -

Genus *Goycoia* RUSCONI, 1950.

This genus was proposed by RUSCONI to include pygidia of two species from the Cambrian of Cerrillo El Solitario, viz. *Goycoia tellecheai* RUSCONI and *G. limpida* RUSCONI; in 1952 the same writer added *G. cerrillensis* RUSCONI from the same locality. No type species was chosen. These pygidia are of a generalized type, which shows considerable resemblance to Asaphiscidae such as *Asaphiscus* MEEK, 1873 and *Blountia* (*Homodictya*) RAYMOND, 1937, and, in the present writer's opinion the validity and position of *Goycoia* must be regarded as problematic until appertinent cephalic parts have been found. Taking the possible validity of *Goycoia* into consideration, *Goycoia tellecheai* RUSCONI, 1950 is here chosen as type species.

Goycoia tellecheai RUSCONI, 1950

Pl. 2, fig. 24

1950. *Goycoia tellecheai* RUSCONI, Rev. Mus. Hist. Nat. Mendoza, Vol. 4, Entregas 3 a-4 a, p. 76, fig. 8.

Material: Three more or less complete pygidia.

Original description: "Pigidio, de 10 mm de longitud por 14.8 mm

de ancho (fig. 8). El pigaxis es estrecho con un ancho casi igual en toda su longitud. Hay 7 levísimos anillos que se los ve únicamente cuando la pieza es colocada en posición perpendicular. De estos bosquejos de anillos los dos primeros son algo más aparentes y los posteriores no están definidos en la parte medial y superior. También en esa posición perpendicular se alcanzan a ver en el ejemplar tipo, pequeñas manchas alargadas u ovaes, dispuestas obliquamente de adentro hacia afuera y adelante.

En la mitad de la concha hay un surco semicircular y entre éste y el borde externo existe una franja ancha y levemente excavata. En cambio, dentro de la periferia determinada por el surco semicircular se advierten 6 levísimas pigopleuras, siendo algo más visibles las anteriores, mientras que las posteriores se alcanzan a ver con dificultad cuando la pieza es colocada perpendicularmente. De esta especie conozco muchos ejemplares con los detalles indicados. Además, la concha de estos pigidios son relativamente chatas, y tanto su ornamentación como los otros trilobitas de Mendoza, motivos por el qual creo que se trata de un nuevo genero tal vez vinculado al grupo *Opisthoparia*."

The specimens at hand agree well with Rusconi's description and figure although the latter shows a more strongly rounded antero-lateral outline, which may probably be due to partly sediment-covered articulating facets. It may be added to Rusconi's description that the axial furrows are narrow and extremely shallow, that the border is crossed by a postaxial ridge, and that the external surface is smooth.

Dimensions of figured pygidium:

Length	14.0 mm
Width	21.0 -
Length of axis	10.0 -
Width - - anteriorly	4.0 -
- - - posteriorly	3.0 -

Goycoia brevicauda n. sp.

Pl. 2, fig. 23

Material: Three more or less complete pygidia.

Description: Pygidium 1.7 times as wide as long, semielliptic in outline, moderately convex. Axis defined by narrow, extremely shallow axial furrows, about 1.8 times as long as wide, moderately tapering, extending to border furrow, occupying about 0.7 of pygidial length and about 0.2 of width, moderately convex, divided by almost effaced transverse furrows into

six hardly visible axial rings and a small, rounded terminal portion. Pleural fields small, showing five faintly indicated segments. Border furrow wide and shallow. Border wide, slightly concave, crossed by faintly indicated postaxial ridge.

External surface smooth.

Dimensions:	I	II (holotype)
Length	6.0	8.0 mm
Width	10.0	14.0 -
Length of axis	4.0	5.5 -
Width - - anteriorly...	2.2	3.0 -
- - - posteriorly..	1.3	1.8 -

Remarks: This species is closely related to *Goycoia tellecheai* RUSCONI (the type species), but differs in having shorter pygidium; it is easily distinguished from *G. cerrillensis* RUSCONI by its shorter pygidium and more tapering axis.

Goycoia pecoralis n. sp.

Pl. 2, fig. 25

Material: A pygidium (natural cast of the interior).

Description: Pygidium about 1.3 times as wide as long, semielliptic in outline, moderately convex. Axis defined by moderately broad, very shallow axial furrows, about 2.5 times as long as wide, moderately tapering, extending to border furrow, occupying about 0.7 of pygidial length and 0.2 of width, moderately convex, divided by faintly indicated transverse furrows into seven flat axial rings and a short, rounded terminal portion. Pleural fields small, showing six faintly indicated segments. Border furrow apparently shallow. Border wide, concave.

Dimensions:

Length	11.0 mm
Width	15.0 -
Length of axis	7.5 -
Width - - anteriorly....	3.0 -
- - - posteriorly...	2.0 -

Remarks: *Goycoia pecoralis* differs from other species of the same genus in having a longer pygidium with narrower, less tapering axis and wider border.

Undetermined specimens

A librigena (Pl. 1, fig. 18) and a fragment of a pygidium (Pl. 2, fig. 26) fail to show sufficient diagnostic characters, and, accordingly, these speci-

mens must remain undetermined until more complete material has been found.

A pygidium (Pl. 2, figs. 18—19) is considered too fragmentary to be safely determined; it shows the general characters of *Coosella*, but it differs from the hitherto known species in its greater width and more strongly sloping border; the lack of *Coosella* cranidia in the material should be noticed in this connection.

A librigena (Pl. 2, fig. 20) is in several respects similar to that of *Coosia*; the hesitation in generic reference is due to the lack of associated *Coosia* cranidia and to the fact that here we have to do with a somewhat generalized type of librigena, which may occur in several different genera.

The Age of the Fauna

In papers of 1950, 1951, and 1952 RUSCONI has published descriptions of a good number of species of trilobites from Cerrillo El Solitario which were referred to the following genera:

<i>Amphoton?</i>	<i>Gallagnostus</i>	<i>Notocoryphe</i>
<i>Asaphellus</i>	<i>Geragnostus</i>	<i>Ogyginus?</i>
<i>Bathyrurus?</i>	<i>Goycoia</i>	<i>Olenoides</i>
<i>Briscoia?</i>	<i>Homagnostus</i>	<i>Parabriscoia</i>
<i>Canotagnostus</i>	<i>Huarpagnostus</i>	<i>Phalacroma</i>
<i>Canotiana</i>	<i>Hypagnostus</i>	<i>Prosaukia?</i>
<i>Clavagnostus</i>	<i>Hystericurus?</i>	<i>Pseudagnostus</i>
<i>Cotalagnostus</i>	<i>Keithiella</i>	<i>Pseudolevinia</i>
<i>Culipagnostus</i>	<i>Levinia</i>	<i>Spinagnostus?</i>
<i>Diplagnostus</i>	<i>Mendodiscus</i>	<i>Tomagnostus?</i>

Nine of these thirty genera, *Canotagnostus*, *Canotiana*, *Culipagnostus*, *Goycoia*, *Huarpagnostus*, *Levinia*, *Mendodiscus*, *Notocoryphe*, and *Pseudolevinia* were published as new genera, and, accordingly, they could not contribute essentially to stratigraphic correlations. Furthermore, these new genera, with the exception of *Canotagnostus*, *Culipagnostus*, *Goycoia*, and *Huarpagnostus*, were placed by contributors to the trilobite volume of the "Treatise of Invertebrate Paleontology" (LOCHMAN and RASETTI 1959) under the heading "Unrecognizable genera".

The stratigraphic range of the other genera (as far as is known) is given in the following table (p. 34) (M.C. = Middle Cambrian, U.C. = Upper Cambrian, L.O. = Lower Ordovician, M.O. = Middle Ordovician).

It appears from this table that eight genera are Middle Cambrian, six genera are Upper Cambrian, four genera are Lower Ordovician, and one genus is Middle Ordovician, whereas one genus is known from Middle and Upper Cambrian and another from Middle Cambrian and Lower Ordovician.

	M.C.	U.C.	L.O.	M.O.
<i>Amphoton?</i>	+			
<i>Asaphellus</i>			+	
<i>Bathyrurus?</i>				+
<i>Briscoia?</i>		+		
<i>Clavagnostus</i>	+	+		
<i>Cotalagnostus</i>	+			
<i>Diplagnostus</i>	+			
<i>Gallagnostus</i>	+		+	
<i>Geragnostus</i>			+	
<i>Homagnostus</i>		+		
<i>Hypagnostus</i>	+			
<i>Hystericurus?</i>			+	
<i>Keithiella</i>		+		
<i>Ogyginus?</i>			+	
<i>Olenoides</i>	+	?		
<i>Parabriscoia</i> ¹		+		
<i>Phalacroma</i>	+			
<i>Prosaukia?</i>		+		
<i>Pseudagnostus</i>		+		
<i>Spinagnostus?</i>	+			
<i>Tomagnostus?</i>	+			

Provided that the generic determinations are correct, the stratigraphic range of the series of strata at Cerrillo El Solitario should be Middle Cambrian to Middle Ordovician, but RUSCONI follows another line of reasoning. In 1950 he referred the fossiliferous strata at Cerrillo El Solitario to the Upper Cambrian in saying: "En la fauna del Cerrillo El Solitario hay elementos vinculados a los del Ordovicio basal de otras naciones, pero los más son del cámbrico superior y hasta del cámbrico medio, motivos por el cual sigo creyendo que el horizonte Villavicense, que ha proporcionado los citados organismos corresponden, por lo menos, al cámbrico superior, siendo su fauna distinta de la del cámbrico de San Isidro" (RUSCONI 1950 b, p. 85).

In 1951 RUSCONI changed his mind and referred the strata to the late

¹ According to LOCHMAN ("Treatise of Invertebrate Paleontology", vol. 0, p. 0254) *Parabriscoia* KOBAYASHI, 1935 is a synonym of *Elkia* WALCOTT, 1924.

Middle Cambrian without further ceremony, and this opinion was maintained in the Cambrian symposium of the 20th International Geological Congress in México ("El Sistema Cámbrico, su Paleogeografía y el Problema de su Base", Pt. 2, p. 759). Provided that this is correct, Rusconi's Upper Cambrian and Ordovician elements in the fauna must be accounted for, and the question of the correctness of determinations must be taken into consideration.

The following comments on Rusconi's genera do not comprise his new genera, which are known from Cerrillo El Solitario only, and, accordingly, without importance with regard to the discussion of stratigraphic correlation.¹

Amphoton?: (RUSCONI 1950 a, p. 84). Not figured. The occurrence of this Asiatic and Australian genus in Argentina is very improbable.

Asaphellus: (RUSCONI 1952, Pl. 1, figs. 1—2). The figures show species of two different genera. The specimens differ clearly from *Asaphellus*, and the occurrence of this Tremadocian genus in association with Cambrian genera is very improbable.

Bathyrus?: (RUSCONI 1950 b, p. 93). Not figured. The occurrence of this Middle Ordovician genus in association with Cambrian genera is very improbable.

Briscoia?: (RUSCONI 1951, p. 26, fig. 22). The specimen differs greatly from this genus in the shape of its pygidial axis.

Clavagnostus: (RUSCONI 1950 a, p. 83, fig. 3). This is certainly not *Clavagnostus* (new genus?).

Cotalagnostus: (RUSCONI 1952, Pl. 1, fig. 12). The generic determination seems to be correct.

Diplagnostus: (RUSCONI 1952, Pl. 1, fig. 10). The generic determination seems to be correct.

Gallagnostus: (RUSCONI 1950 a, p. 83, fig. 2). The specimen should be referred to *Phoidagnostus* WHITEHOUSE.

Geragnostus: (RUSCONI 1950 a, p. 83, fig. 1). The specimens differ clearly from this Tremadocian genus in cephalic and pygidial outline, and in shape and proportions of the glabella and the pygidial axis.

Homagnostus: (RUSCONI 1950 b, p. 94, fig. 9). This specimen differs greatly from *Homagnostus* in the shape of the pygidial axis and the posterior border; provided that the specimen is correctly figured, the species in question must be regarded as belonging to a new genus.

Homagnostus: (RUSCONI 1951, p. 26, fig. 21). The specimen differs clearly from *Homagnostus* in the shape and segmentation of the pygidial axis.

Hypagnostus: (RUSCONI 1952, Pl. 1, figs. 7—9). The generic determination may be correct.

Hystericurus?: (RUSCONI 1951, p. 26, fig. 27). This very fragmentary specimen differs greatly from *Hystericurus* in the shape of the "glabella", which shows considerable resemblance to the pygidial axis of an agnostid trilobite.

¹ It should be noticed in this connection that most of the present writer's comments are given mainly with regard to Rusconi's figures, as circumstances beyond the writer's control prevented a study of the actual specimens.

- Keithiella?*: (RUSCONI 1951, p. 26, fig. 25). The specimen differs clearly from *Keithiella* in the shape of the pygidial axis and the number of axial rings.
- Ogyginus?*: (RUSCONI 1950 a, p. 84). Not figured. The occurrence of this Lower Ordovician genus in association with Cambrian genera is very improbable.
- Olenoides*: (RUSCONI 1950 a, p. 83, fig. 10). Provided that the specimen (a pygidium) is correctly figured, it differs clearly from *Olenoides* in the shape of the axis and the lack of pleural furrows.
- Parabriscoia*: (RUSCONI 1951, p. 26, fig. 23). As mentioned above (p. 34), *Parabriscoia* is a junior synonym of *Elkia* WALCOTT. The specimen differs from *Elkia* in the location of the pleural furrows.
- Phalacroma*: (RUSCONI 1950 b, p. 94, fig. 5). Judging from the figure this may be *Cotalagnostus*.
- Prosaugia*: (RUSCONI 1950 a, p. 82). Not figured; the description does not fit in with the characters of *Prosaugia*.
- Pseudagnostus*: (RUSCONI 1950 b, p. 94, fig. 6). The short glabella, the lack of a preglabellar longitudinal furrow, and the shape of the pygidial axis clearly show that the specimen should not be referred to the Pseudagnostidae.
- Spinagnostus?*: (RUSCONI 1952, Pl. 1, fig. 5). Provided that the specimen is correctly figured, it may be referred to *Spinagnostus*.
- Tomagnostus?*: (RUSCONI 1951, p. 26, fig. 29). This "cranideo" is estimated to represent a pygidium of the new genus *Stigmagnostus* (p. 15).

It appears from the above comments that the agnostid genera *Cotalagnostus*, *Diplagnostus*, *Hypagnostus*, and *Spinagnostus* may be represented in RUSCONI'S material, and to these may be added *Phoidagnostus* (= *Gallagnostus* of RUSCONI).

The stratigraphic range of many agnostid trilobites is well-known owing to WESTERGÅRD'S excellent monograph of 1946. In the Scandinavian-Baltic region *Cotalagnostus* ranges from the *Tomagnostus fissus* zone to the *Jincella brachymetopa* zone, *Diplagnostus* from the *Ptychagnostus punctuosus* zone to the *Lejopyge laevigata* zone, *Hypagnostus* from the *Tomagnostus fissus* zone to the *Jincella brachymetopa* zone, and *Phoidagnostus* is characteristic of the *Jincella brachymetopa* zone. *Spinagnostus* is known from the *Centroleura vermontensis* zone (St. Albans formation) of northwestern Vermont. Accordingly, the age of the strata of Cerrillo El Solitario appear to be late Middle Cambrian, and the "Upper Cambrian" and "Ordovician" genera in RUSCONI'S lists of fossils from this locality call for revision.

The material collected by the present writer contains representatives of nine agnostid genera, viz. *Aagnostus*, *Baltagnostus*, *Clavagnostus*, *Diplagnostus*, *Kormagnostus*, *Oedorhachis*, *Peronopsis*, *Phoidagnostus*, and *Stigmagnostus*. The stratigraphic range of five of these genera is well-known in the Acado-Baltic province (WESTERGÅRD 1946); their vertical distribution is shown in the following table (p. 37).

	MIDDLE CAMBRIAN												
	UPPER CAMBRIAN												
	<i>Paradoxides forchhammeri</i>	<i>Paradoxides paradoxissimus</i>	<i>Paradoxides oelandicus</i>	<i>Agnostus pisiformis</i>	<i>Leipyge laevigata</i>	<i>Jincella brachymetopa</i>	<i>Triplagnostus lundgreni</i> and <i>Goniagnostus nathorsti</i>	<i>Ptychagnostus punctuosus</i>	<i>Hypagnostus parvifrons</i>	<i>Tomagnostus fissus</i> and <i>Ptychagnostus alvus</i>	<i>Triplagnostus gibbus</i>	<i>Paradoxides pinus</i>	<i>Paradoxides insularis</i>
Acado-Baltic agnostid genera from Cerrillo El Solitario													
<i>Agnostus</i>				+	+								
<i>Clavagnostus</i>					+								
<i>Diplagnostus</i>					+		+						
<i>Peronopsis</i>							+	+			+		
<i>Phoagnostus</i>													
* <i>Cotalagnostus</i>										+			
* <i>Hypagnostus</i>											+		

* Genera not represented in the writer's material.

It clearly appears from the vertical distribution of agnostid genera shown in the above table that the age of the fauna of Cerrillo El Solitario is late Middle Cambrian and that the strata constitute a strati-

graphic equivalent of the Acado-Baltic *Paradoxides forchhammeri* stage, most probably the *Jincella brachymetopa* zone.

The occurrence of *Bolaspidella* in the material is of special interest. This genus is characteristic of the so-called Pacific province of North America, and its presence in the Cerrillo El Solitario fauna must be regarded as an indication of stratigraphic and correlative importance. The species of *Bolaspidella* are dominant faunal elements in the late Middle Cambrian *Bolaspidella* zone although in the Upper Cambrian cratonic realms of Texas (Llano uplift), Montana-northern Wyoming, and in the Upper Cambrian intermediate realm of Vermont and Gaspé this genus penetrates into the *Cedaria* zone of the Dresbachian (LOCHMAN & WILSON 1958). In the *Bolaspidella* zone of the Pacific province of North America the genus *Bolaspidella* is associated with *Baltagnostus*,¹ and this is also the case in the Cerrillo El Solitario fauna. As mentioned above, the Acado-Baltic agnostid genera in the Cambrian fauna of Cerrillo El Solitario constitute strong evidence that the strata of this locality should be correlated with the *Jincella brachymetopa* zone of the Acado-Baltic *Paradoxides forchhammeri* stage, and the association of these elements with the Pacific *Bolaspidella* and *Baltagnostus* indicates that the Cerrillo El Solitario strata, the *Jincella brachymetopa* zone, and the *Bolaspidella* zone should be regarded as stratigraphic equivalents.

It is well-known that during the greater part of the Cambrian period the Pacific and the Acado-Baltic provinces were very effectively separated from each other; for this reason it has been postulated that a barrier, the so-called New Brunswick geanticline, extended along the northwest margin of the Acadian geosyncline so as to prevent the mingling of the faunas from the two separate realms. However, HOWELL (1937) described the *Centropleura vermontensis* fauna from the St. Albans formation of northwestern Vermont in which *Centropleura* and another Acado-Baltic genus, *Elyx*, are found associated with Pacific ones, *inter alia* *Bolaspidella*. This fauna was placed by HOWELL & DUNCAN (1939, p. 5) as late Middle Cambrian, and it was regarded as a little younger than the *Paradoxides forchhammeri* fauna. However, in Scandinavian areas of continuous sedimentation (alum shale series) the *Paradoxides forchhammeri* stage constitutes the very top of the Middle Cambrian, and the youngest zone of this stage, the *Lejopyge laevigata* zone, is followed without hiatus by the lowermost zone of the Upper Cambrian, the *Agnostus pisiformis* zone; in view of this fact the youngest

¹ Lowermost part of the Riley formation (central Texas) and Conasauga shale (S. Appalachians).

possible Acado-Baltic stratigraphic equivalent of the St. Albans formation must be the *Lejopyge laevigata* zone of the *Paradoxides forchhammeri* stage. In consideration of the fact that *Centropleura vermontensis* appears to be very closely related to species in the *Jincella brachymetopa* zone of the Acado-Baltic province and that in Scandinavia species of *Elyx* have not been found above this level, the present writer is of opinion that the St. Albans formation should be regarded as a stratigraphic equivalent of the *Jincella brachymetopa* zone.

It is a remarkable fact that in northwestern Vermont and in the Mendoza region of Argentina invasion of late Middle Cambrian Acado-Baltic trilobite genera into the Pacific province took place simultaneously.

In addition to the Cerrillo El Solitario locality other Middle Cambrian occurrences are known from the Zonda region west-northwest of the city of San Juan and from the San Isidro region west of the city of Mendoza; these somewhat older Middle Cambrian occurrences belong to the *Glossopleura* zone, as pointed out by V. POULSEN (1958); thus the Middle Cambrian remained Pacific up to *Bolaspidella* time, when Acado-Baltic invasion changed the character of the fauna. The data at hand suggest a transgressive tendency in late Cambrian time leading to mingling of Pacific and Acado-Baltic faunas in the western hemisphere.

The palaeogeographical conditions in South America during the Cambrian are practically unknown owing to the lack of satisfactory evidence, but in the writer's opinion it seems probable that the Acado-Baltic invasion penetrated into the Mendoza region via the Jujuy embayment of HARRINGTON & LEANZA (1957, p. 42); the existence of this embayment in the northern Argentine has been ascertained by these authors on the basis of a magnificent fossiliferous series of Ordovician formations with a pronounced Acado-Baltic affinity.

Zonal division in Cerrillo El Solitario

In 1956 RUSCONI published a table, representing his interpretation of the Middle Cambrian sequence of strata in the Mendoza region; in this table he introduces a division of the Cambrian of Cerrillo El Solitario ("Horizonte Villavicense") into five zones, and a number of species are referred to each of them. Such zonal division had not been accomplished in 1955, when the present writer visited the locality, and owing to the fact that the expedition was about to leave the Argentine, it was necessary to concentrate on the collection of fossils from a greatly fossiliferous limestone bed on top of the

hill very close to the southern slope; therefore, it is not the writer's intention to take up a definite attitude with reference to the zonal division proposed by RUSCONI; one observation, however, must be mentioned. The material described in the present paper contains well-preserved specimens of *Goycoia tellecheai* RUSCONI, which was presented by RUSCONI as characteristic of Zone 1, and specimens of *Phoidagnostus solitariensis* (RUSCONI), which was presented as characteristic of Zone 4, are found associated with the former. This fact is mentioned only to indicate that further collection and study may be necessary in order to establish a safe basis for zonal division of the series of strata.

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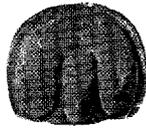
PLATES

PLATE 1

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-	14. <i>Clavagnostus chipiquensis</i> (RUSCONI), pygidium, × 10	9
-	15. <i>Phoidagnostus solitariensis</i> (RUSCONI), pygidium, × 5	14
-	16—17. <i>Prometeoraspis canolensis</i> n. sp., dorsal and lateral views of cranium (holotype), × 3	17
-	18. Genus et sp. ind., librigena, × 1.5	32
-	19—24. <i>Williamsina cortesi</i> n. sp.	19
	Fig. 19—21, dorsal, frontal, and lateral views of cranium (holotype), × 3; fig. 22, librigena, × 3; fig. 23—24, dorsal and lateral views of pygidium, × 3.	
-	25—28. <i>Williamsina mikkelsenii</i> n. sp.	21
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-	29. <i>Williamsina harringtoni</i> n. sp., pygidium (holotype), × 3	20



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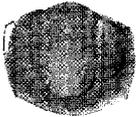
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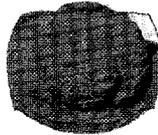
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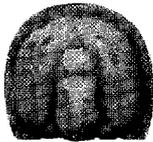
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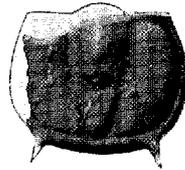
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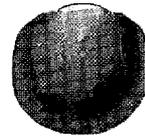
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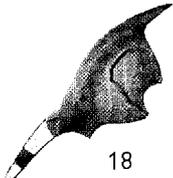
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PLATE 2

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- 13—15. <i>Talbotinella rusconii</i> n. sp., dorsal, lateral, and frontal views of cranidium without posterior areas of fixigenae (holotype), × 1.5	27
- 16—17. <i>Bolaspidella lucieae</i> n. sp.	28
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- 24. <i>Goycoia tellecheai</i> Rusconi, large pygidium, × 1.25	30
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- 26. Genus et sp. ind., fragmentary pygidium, × 1	32



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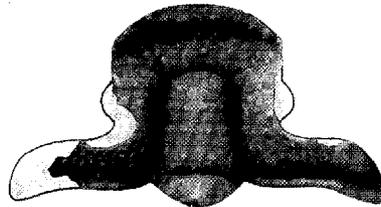
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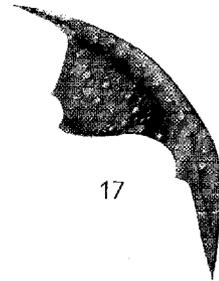
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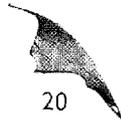
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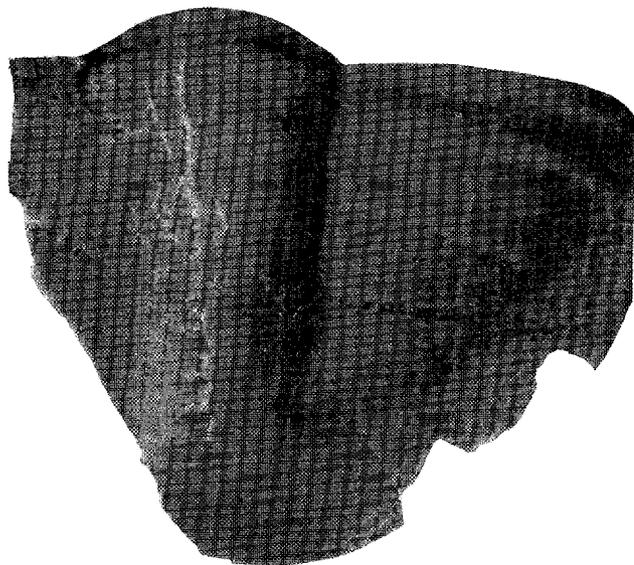
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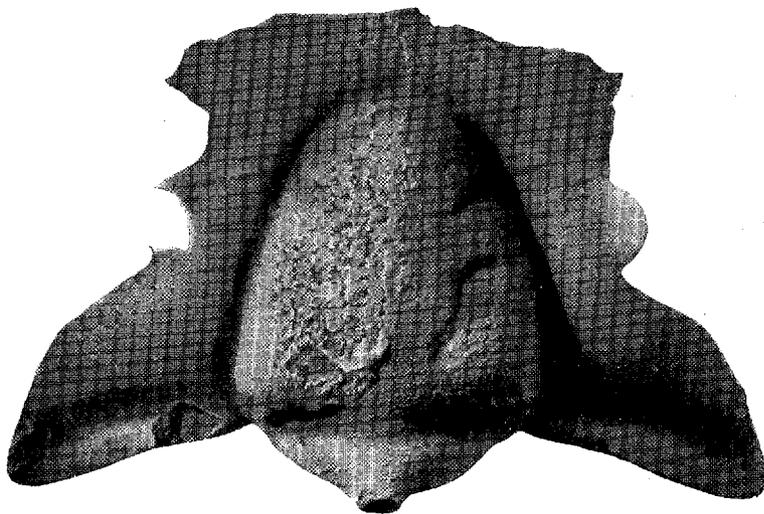
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PLATE 3

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Fig. 1. <i>Williamsina ornata</i> n. sp., pygidium (holotype), showing surface markings on border, × 15	22
- 2. <i>Talbotinella communis</i> n. sp., cranidium, showing surface markings, × 7.5	24



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