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FOSSILIFEROUS HORIZONS IN THE "SILLERY FORMATION" NEAR LÉVIS, QUEBEC.

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ABSTRACT. New fossiliferous localities were discovered in the vicinity of Lévis, Quebec, in rocks that have hitherto been assigned to the "Sillery formation." A 1700 feet thick section of strata in clearly recognizable order is described. At the base of this section is a shale with thin layers of limestone, containing Lower Cambrian trilobites; this horizon is designated as the *Austinvilla* zone. Somewhat higher in the section is a limestone conglomerate, whose boulders also yield Lower Cambrian fossils. Near the top of the section, thin limestone beds in the shale yielded a few fossils that appear to be of Canadian age; this horizon is designated as the *Ellsaspis* zone.

The conclusion of this work is that the "Sillery," even within the limited area investigated, includes strata that are similar lithologically, but on paleontologic evidence prove to belong to widely different ages. Hence these rocks will have to be subdivided into several formations when their stratigraphy is better understood.

A new genus, *Pagetides,* eight new species of Lower Cambrian trilobites, and *Ellsaspis,* a new genus of Canadian(?) trilobites are described. The systematic position of the eodiscids is discussed.

INTRODUCTION.

THE belt of lower Paleozoic rocks that crops out on the south shore of the St. Lawrence river for over 200 miles below Quebec City has not yet been assigned a precise place in the stratigraphic column. Most of these rocks are usually designated, after Logan, by one formational name, the "Sillery," although there is no convincing proof that they belong to one formation; but all the attempts toward a subdivision have remained unsuccessful(1-6).*

It now appears likely that the "Sillery" represents an assemblage of formations which, notwithstanding a remarkable lithologic uniformity, probably range from Lower Cambrian to Canadian.

Fossils had been found in place in rocks assigned to the "Sillery" only within two limited areas. Grey shales at the typical locality yield a brachiopod, described by Billings as

* Numbers in parentheses refer to the literature cited.

Obolella pretiosa and recently referred by Ulrich and Cooper(7) to the genus *Botsfordia*. According to these authors, this fossil indicates a Lower or Middle Cambrian age for the shale in question. When the use of the name, "Sillery," is properly restricted, it should be reserved for rocks that are coformational with this shale, which will henceforth be designated as the *Botsfordia pretiosa* shale. The other fossil localities lie two hundred miles to the northeast, in the region of Métis and Matane. Howell(8) has recently shown that these outcrops are probably of Canadian age.

DESCRIPTION OF THE OUTCROPS.

The section here described is exposed at Ville Guay, 4½ miles east of Lévis, on the south shore of the St. Lawrence river. A regular succession of strata begins near two conspicuous bands of conglomerate, and can be followed eastward for about half a mile. Beyond these limits, strong folding and faulting obscure the stratigraphic succession; but within the limits of the section here described, the strata maintain an approximately constant strike and dip. Moreover, none of these strata are concealed, and hence any angular unconformities that might be present could be readily observed.

The strata strike N. 32° to 35° E. (magnetic) and dip 60° to 70° to the east. The succession in ascending order is the following.

	Feet
Grey, rusty-weathering shale, with a few thin, generally lenticular beds of impure, dark grey, fossiliferous limestone (*Austinvillia* zone, fossil locality 1).	11+
Conglomerate, containing grey limestone pebbles in a sandstone matrix. No fossils were observed in the pebbles...	12
Grey shale, with thin sandstone beds.	12
Limestone conglomerate, with very little paste. Many of the boulders are abundantly fossiliferous, and contain a Lower Cambrian fauna (fossil locality 2).	10
Grey and green shale, with thin sandstone beds.	610
Alternating layers of shale and thick-bedded sandstone.	35
Grey and green shale with thin sandstone beds.	240
Alternating layers of shale and thick-bedded sandstone.	140
Grey and green shale	110
Red, grey and green shale	360
Green and grey shale.	36
Grey shale, with six or seven layers, 2 to 3 inches thick, of dark-grey, sparsely fossiliferous limestone (*Ellsaspis* zone, fossil locality 3).	3
Green shale	90

Equivalent strata, but in a much more disturbed condition, are exposed across the river, on the south shore of the Island of Orléans. Here fossils were collected only from the conglomerate boulders (fossil locality 4).

AGE OF THE STRATA.

The paleontologic evidence enables one to draw conclusions only about the age of the strata at the two widely separated horizons where fossils were collected in place. The fossils occurring in the conglomerate boulders are of little use for this purpose; hence the latter fauna will not be described, excepting a few species which are interesting for their relationship with the fauna of the thin-bedded limestone at locality 1.

The fauna of the thin-bedded limestone at locality 1 includes the following species:

Austinvillia bicensis Resser.
Bonnia sp.
Pagetides amplifrons Rasetti, n. sp.
Pagetides pustulosus Rasetti, n. sp.
Periomma punctata Rasetti, n. sp.

The writer suggests the name, *Austinvillia* zone, for this horizon, since *Austinvillia* is a well-characterized trilobite, known from the Lower Cambrian of the southern Appalachians and other areas. *Bonnia* is a prolific Lower Cambrian genus of wide geographic distribution in North America. *Periomma* is also a Lower Cambrian genus. All these trilobites appear to indicate an approximate correlation with the Forteau of Labrador and Newfoundland and the Shady of the southern Appalachians, although it is possible that the *Austinvillia* zone is somewhat younger than the above-mentioned formations.

No precise correlation could be attempted even if a larger fauna were available, since little is known at present about the stratigraphic range of Lower Cambrian genera(9).

The conglomerate boulders at the localities 2 and 4 yield a large fauna. Fossils in this conglomerate were first discovered by Ells(3), and three species, *Nisusia* (*Jamesella*) *amii* Walcott, *Kootenia ellsi* (Walcott), and *Periomma walcotti* Resser, have been described. The writer has assembled a large collection of trilobites from these boulders. The following genera have been recognized: *Alokistocare, Austinvillia, Bicaspis, Bonnia, Kootenia, Olenoides, Paedeumias, Pagetia, Pagetides, Periomma, Periommella, Prozacanthoides, Ptychoparella,*

Solenopleurella, Syspacephalus, Wanneria, Zacanthoides. Several of these genera range from the Lower to the Middle Cambrian, but the presence of the olenellids proves beyond doubt that the age of the fauna is Lower Cambrian. Two of the species, *Austinvillia bicensis* and *Pagetides amplifrons*, also occur in the thin-bedded limestone of the *Austinvillia* zone, and the other species of this zone have close relatives in the conglomerate. Hence we may conclude that the boulders are at least approximately of the same age as the *Austinvillia* zone. It must be emphasized, however, that lithologically the two limestones are quite different, the boulders indicating that they were derived from a massive limestone. It is a well-known fact(10) that it has been impossible to discover the source of any of the limestone boulders of different ages that occur in conglomerates in the Lévis area and farther east on the shore of the St. Lawrence river.

There remains to be discussed the fauna of the thin-bedded limestone at the locality 3, 1600 feet above the Lower Cambrian *Austinvillia* zone. Unfortunately, the material available is very scarce and rather poorly preserved. It includes two species of brachiopods and a trilobite. Dr. G. A. Cooper, to whom the brachiopods were submitted, informed the writer that no positive identification could be attempted with the material in hand, but that the two species suggest *Orthis panderiana* Hall and Clarke and *Orthis? billingsi* Ulrich and Cooper (not Hartt). These species were described from Billings' limestone no. 2 at Lévis, and hence are probably of Canadian age. The trilobite is quite distinctive, but unfortunately belongs to a new genus and species, and it cannot be used for correlation. It is here described as *Ellsaspis elliptica*, and the horizon from which the fossils were collected is designated the *Ellsaspis* zone. It is hoped that students of early Paleozoic faunas may be able to recognize this trilobite from strata of known age and hence more definitely to determine the stratigraphic position of the *Ellsaspis* zone. It will tentatively be assumed, on the evidence of the brachiopods, that the *Ellsaspis* zone is of Canadian age. One conclusion may be drawn with certainty, *i.e.*, that the *Ellsaspis* zone is younger than Lower Cambrian, and hence the described strata are not overturned. This is important, since the "Sillery" rocks often present overturned folds, and previous workers usually were not certain in which order their sections were described.

The evidence now available does not enable one to make any definite statements about the age of the strata between the Lower Cambrian *Austinvillia* zone and the supposedly Canadian *Ellsaspis* zone. Although no angular or erosional unconformities could be observed in the section, it is likely that long time intervals are not represented.

Little can be said about the relative stratigraphic position of the strata here described and other sections of the "Sillery," since the latter are usually unfossiliferous. We do not know whether the *Botsfordia pretiosa* shale is represented in the Ville Guay section, as this fossil could not be found there. Lithology can be of little aid, owing to the uniform type of sedimentation that appears to have prevailed in this area during the Cambrian and the early Ordovician.

The general conclusion that may be drawn from the discovery of the new fossiliferous localities, is that the rocks that have been indiscriminately assigned to the "Sillery" range over a vast time interval, and will have to be subdivided, once their stratigraphy is better understood. This task will be a particularly difficult one, owing to the extreme scarcity of fossils, the complicated structure, and the unreliability of lithologic criteria.

ACKNOWLEDGMENT.

The writer is greatly indebted to Dr. G. Arthur Cooper for examining the brachiopods of the *Ellsaspis* zone and for supplying casts of types in the U. S. National Museum.

SYSTEMATIC DESCRIPTIONS.

TRILOBITA.

Order EODISCIDEA Richter.

Since the species here described bring some new contribution to the knowledge of the eodiscid trilobites, a few remarks regarding the affinities of this group seem appropriate. Several authors realized the distinctness of the eodiscids from most of the other trilobites and erected for them a special taxonomic group. Thus Jaekel(11) divided the trilobites into two orders, Miomera and Polymera, the former containing the agnostids and the eodiscids. Richter(12) and Kobayashi(13) respectively used the superfamily Eodiscidea and the suborder Agnostida in the same sense as Jaekel's Miomera. Whitehouse(14) first recognized the deep distinction between the agnostids

and the eodiscids, and while admitting the primary division of the trilobites into Miomera and Polymera, subdivided the former order into the suborders Eodiscidea and Agnostida.

Lately, students of early Paleozoic crustacea have realized that the distinction between the agnostids and all of the other trilobites is of a more fundamental nature than had hitherto been suspected, and Resser(15) first proposed that the agnostids should constitute a subclass equal in rank to the trilobites. This classification has been adopted in Shimer and Shrock's "Index Fossils of North America."

Once the agnostids have been separated from the eodiscids, there remains the question whether the latter are sufficiently distinct from the other trilobites to be placed in a high-ranking taxonomic group (such as an order or a suborder) by themselves. The writer believes that this is the case, since there appear to be no known forms to bridge the gap between the eodiscids and the multisegmented trilobites.

The Eodiscidea might be characterized as follows. Small trilobites with subequal cephalon and pygidium, and two or three thoracic segments. Fixigenes generally separated in front of the glabella by a longitudinal depression. Cephalic rim usually with a row of tubercles, pits or radial impressions. Animal either blind, and then lacking dorsal cephalic sutures; or possessing eyes and small libragenes of the proparian type. Pygidium usually rather elongate, with a long axis in which several segments (usually 5 to 10) are represented. Genal spines lacking; occipital spine usually developed. Stratigraphic range: Lower and Middle Cambrian.

At first sight, the distinctness of the eodiscids from other trilobites would seem to be impaired by the existence of such forms as some of those here described under the genus *Pagetides*. The cranidia of these species bear some resemblance to those of certain ptychoparid trilobites, particularly of such genera as *Periomma* which possess a wide convex rim. However, the writer believes that this resemblance is purely superficial, as it applies only to the cranidium. It must be considered that these ptychoparid trilobites have opisthoparian sutures and relatively large libragenes with strong genal spines, a multisegmented, tapering thorax and an extremely small pygidium. It is now generally admitted by students of trilobites that caudalization is a progressive character(16, 17). The fact that the eodiscids already present such a high degree

of caudalization, and corresponding reduction of the number of thoracic segments, as early as the Lower Cambrian, when most other trilobites were just at the beginning of the process of caudalization, shows that the eodiscids represent a branch that had very early diverged from the main line of development of the trilobite stock. Probably this differentiation had already taken place in the pre-Cambrian.

On the other hand, there seems to be little doubt about the homogeneity of the eodiscids. Forms that possess libragenes and eyes and forms that do not are so similar in all other respects that their close relationship is obvious. Among the suture-bearing forms, there is an almost continuous series of species that bridge the gap between the more typical eodiscid trilobites and the forms whose cranidium assumes a superficial ptychoparid aspect. The species described in this paper bring some new evidence on this point.

Thus the whole of the known evidence seems to favor the segregation of the eodiscids in a special order or suborder.

Genus PAGETIDES Rasetti, n. gen.

Small proparian trilobites with cephalon and pygidium of subequal size. Glabella narrow, cylindrical or slightly tapered, faintly furrowed, most elevated posteriorly, extended into a strong occipital spine. Fixigenes as wide as the glabella, convex, attaining their maximum relief posteriorly; separated in front of the glabella by a depression. Rim of variable width in the different species; widest in front and narrowing toward the genal angles. Rim marked with a row of more or less distinct radial impressions. Ocular ridges indistinct; palpebral lobes of moderate length, very narrow, submarginal in position, separated from the fixigenes by distinct furrows. Facial sutures directed straight to the lateral margin of the cephalon both in front and behind the eyes. Hence the libragenes (missing in all the observed specimens) must have been only as long as the palpebral lobes; their position was vertical, on account of the great convexity of the posterolateral portions of the head. The posterior branch of the facial sutures reaches the margin in advance of the genal angle by a distance equal to the length of the libragene. The narrow lateral rim is continued behind the libragene, then turns around the genal angle, without being produced into a spine, and merges with the posterior rim, which is set off by a well-impressed intramarginal furrow.

Thorax unknown. Pygidium of about equal length and width, strongly convex. Axis narrow, almost reaching the posterior margin, with five to eight segments. Pleural lobes smooth, except for the anterior intramarginal furrow; rim extremely narrow.

Genotype, *Pagetides elegans* Rasetti, n. sp.

The genus appears to differ from *Pagetia* in the longer and more distinct palpebral lobes, cephalic rim of less uniform width and with less distinct radial impressions, and in the lack of an axial spine on the pygidium.

There is the possibility that the species here described as *Pagetides* should be referred to *Hebediscus*, but the writer prefers not to do so on account of the very doubtful status of this genus. Whitehouse(14) based the genus on *Ptychoparia attleborensis* Shaler and Foerste, described from the Hoppin of Massachusetts; but he evidently had in mind the complete specimens from England, assigned to that species and figured by Cobbold(18), who referred them to *Pagetia*. Resser(19) has stated that the specimens from England and Massachusetts are not conspecific; but, as a matter of fact, from the descriptions and illustrations it is not even apparent that they are congeneric. It is likely that the English specimens represent an eodiscid; while the real *Ptychoparia attleborensis* from Massachusetts, on which *Hebediscus* must be based, may be a trilobite of ptychoparid affinities as it was originally described. Hence it is not certain that *Hebediscus* is, as Whitehouse meant it to be, a genus of eodiscids, and the present forms, which in the writer's mind are true eodiscids, are not referred to it.

EXPLANATION OF PLATE 1.

Figs. 1-6. *Pagetides amplifrons* Rasetti, n. sp. 1, holotype cranidium, x8 (loc. 4); 2, 3, cranidia, x6; 4, 5, pygidia, x6 (loc. 2). 6, cranidium, x6 (loc. 1).

Figs. 7-10. *Pagetides leiopygus* Rasetti, n. sp., x6. 7, cranidium; 8, 9, top and side views of holotype cranidium; 10, pygidium (loc. 2 and 4).

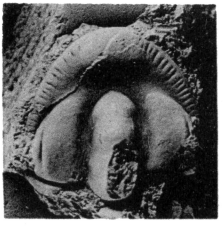
Figs. 11, 12. *Pagetides minutus* Rasetti, n. sp., x6. 11, holotype cranidium; 12, pygidium (loc. 4).

Figs. 13, 14. *Pagetides pustulosus* Rasetti, n. sp. Holotype cranidium, x6 and x12 (loc. 1).

Figs. 15-18. *Pagetides elegans* Rasetti, n. sp., x6. 15, 16, top and side views of holotype cranidium; 17, another cranidium; 18, pygidium (loc. 2).

Fig. 19. *Periomma punctata* Rasetti, n. sp. Holotype cranidium, x6 (loc. 1).

Figs. 20-22. *Bonnia* sp. undet., x6. 20, cranidium; 21, 22, pygidia (loc. 1).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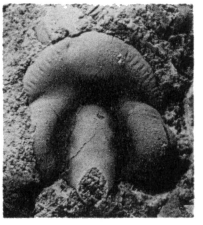
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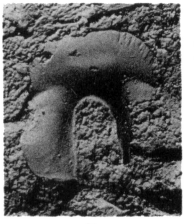
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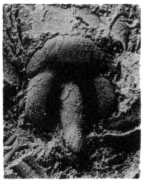
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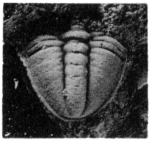
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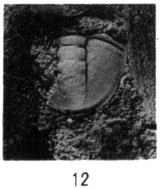
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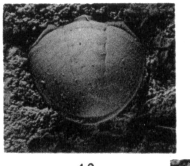
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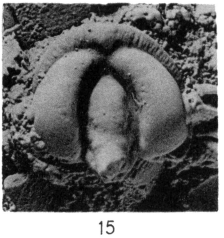
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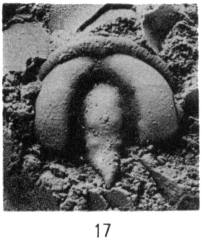
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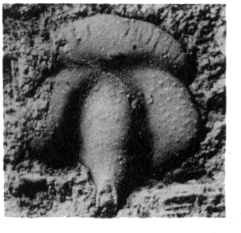
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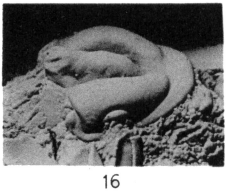
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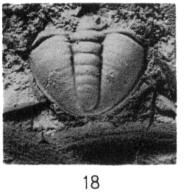
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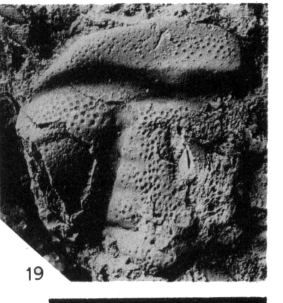
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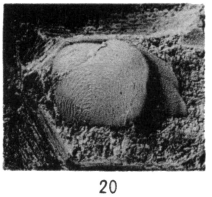
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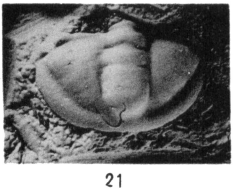
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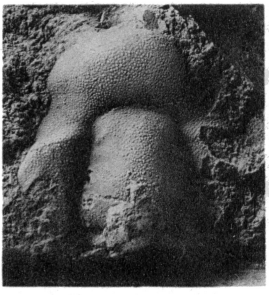

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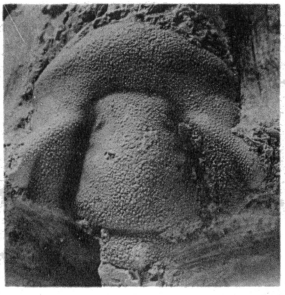

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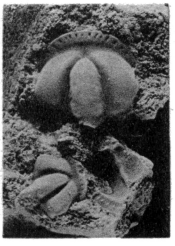

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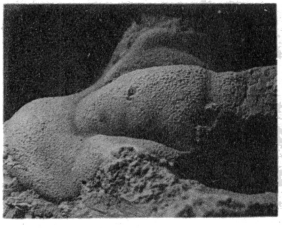

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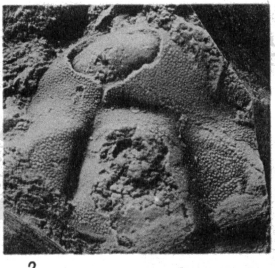

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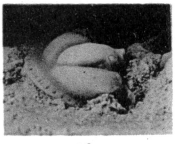

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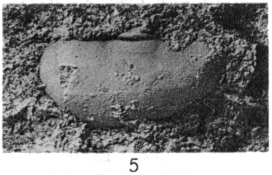

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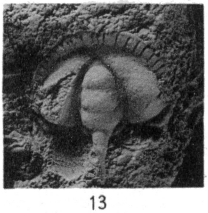

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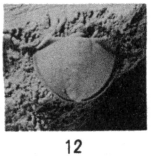

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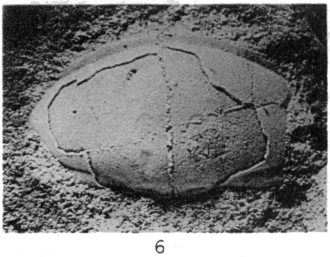

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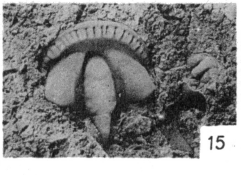

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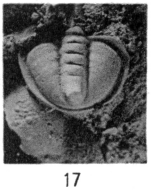

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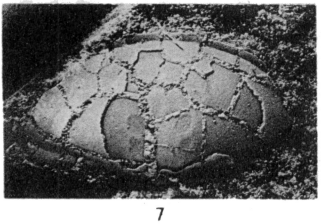

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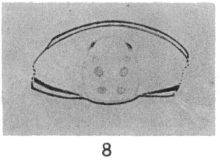

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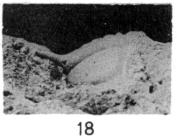

18

PAGETIDES ELEGANS Rasetti, n. sp.

Plate 1, Figs. 15-18.

This species is represented by finely preserved material that shows every detail of the cranidial and pygidial features. The fixigenes are strongly convex transversely, and rise as high as the glabella. They are separated in front of the glabella by a longitudinal depression that joins the anterior furrow to the dorsal furrow. The rim is rather well defined, narrow, and somewhat expands backward at the center. Glabellar and occipital furrows faintly impressed at the sides; occipital spine rather short, pointed, somewhat upturned. The side view of the holotype clearly shows the position occupied by the small, vertical, proparian libragene.

Pygidium wider than long, well rounded posteriorly. Six or seven axial furrows are visible. The dorsal furrows are deep, but the axis does not rise much above the pleural lobes. Length of largest cranidium 4 mm.

Holotype and paratypes: Laval Univ. nos. 304 a-c.
Lower Cambrian boulder at locality 2.

PAGETIDES MINUTUS Rasetti, n. sp.

Plate 1, Figs. 11-12.

The cranidium of this form differs from the preceding species in possessing a slightly wider rim. The glabella is somewhat pointed in front, and the occipital furrow is impressed on the sides. The occipital spine is narrow, upturned.

The associated pygidium has shallower dorsal furrows than in the preceding species, and only three or four axial furrows are visible. Length of largest cranidium 2 mm.

EXPLANATION OF PLATE 2.

Figs. 1-4 *Austinvillia bicensis* Resser, x6. 1, 2, incomplete cranidia (loc. 1); 3, 4, top and side views of cranidium (loc. 4).

Figs. 5-8. *Ellsaspis elliptica* Rasetti, n. gen., n. sp., x6. 5, pygidium; 6, artificial cast of the holotype cranidium, a natural mold; 7, another, poorly preserved cranidium; 8, drawing of cranidium, x3, based on the above-figured specimens (loc. 3).

Figs. 9-12. *Pagetia billingsi* Rasetti, n. sp., x6. 9, cranidia, the larger one being the holotype; 10, side view of holotype cranidium; 11, 12, pygidia (loc. 2).

Figs. 13-18. *Pagetia ellsi* Rasetti, n. sp., x6. 13, cranidium; 14, 15, side and top views of holotype cranidium; 16, 17, side and top views of pygidium; 18, side view of another pygidium preserving the axial spine (loc. 4).

Holotype and paratype: Laval Univ. nos. 302 a-b.
Lower Cambrian boulder at locality 4.

PAGETIDES LEIOPYGUS Rasetti, n. sp.

Plate 1, Figs. 7-10.

Cranidium similar to that of the preceding species, differing only in the wider frontal rim.

The pygidium that occurs associated with this cranidium is almost completely smooth, the dorsal furrows being faintly indicated and the axis hardly rising above the general convexity of the shield. Length of largest cranidium 2.5 mm.

Holotype and paratypes: Laval Univ. nos. 301 a-f.
Lower Cambrian boulders at localities 2 and 4 (holotype from former locality).

PAGETIDES PUSTULOSUS Rasetti, n. sp.

Plate 1, Figs. 13-14.

In this species, the glabella is less parallel-sided than in the preceding ones, tapering both in front and at the posterior end, where it extends into an occipital spine of unknown length. Rim as wide as in *P. leiopygus*, with faint radial impressions. Surface of fixigenes covered with small tubercles.

An imperfect associated pygidium has a prominent, furrowed axis and smooth pleural lobes. Length of holotype cranidium 2.5 mm.

Holotype and paratypes: Laval Univ. nos. 303 a-c.
Thin-bedded limestone at locality 1.

PAGETIDES AMPLIFRONS Rasetti, n. sp.

Plate 1, Figs. 1-6.

This species is chiefly characterized by the great expansion of the rim at the center. Hence the cranidium is proportionately narrower and longer than in all the preceding species. The anterior and dorsal furrows join in a fairly wide, depressed preglabellar area.

Glabella subcylindrical, almost furrowless, extended into a wide, blunt, slightly upturned occipital spine. There is just a suggestion of the occipital furrow at the sides. Ocular ridges are faintly visible on some of the specimens under proper lighting.

The cranidium of this species superficially resembles those of certain ptychoparids, but the proparian sutures show that there is no relationship with that group.

The pygidium which undoubtedly belongs to this species (as it was found associated with the cranidia in several instances) is proportionately narrower and longer than that of *P. elegans*. The axis is narrow and strongly elevated, and eight segments are represented. The first two axial furrows are well impressed, the following are visible only on the central part of the axis. The pleural lobes show a few indistinct furrows, and possess an extremely narrow rim.

Length of largest cranidium 4 mm., of pygidium 3 mm.

Holotype and paratypes: Laval Univ. nos. 300 a-f. Lower Cambrian boulders at localities 4 (typical locality) and 2. An imperfect cranidium (Laval Univ. no. 311) collected from the thin-bedded limestone at locality 1 is figured besides the types.

Genus PAGETIA Walcott, 1916.

Species of *Pagetia* have been described from the Middle Cambrian of the Cordilleran province, Kashmir, China and northeastern Australia. So far the genus has not been reported from Lower Cambrian strata, although some species occur in the earliest Middle Cambrian (*Ptarmigania* zone of the Wasatch mountains). The presence of *Pagetia* associated with Olenellids in the conglomerate boulders near Lévis therefore represents an extension of the known stratigraphic range of the genus. There appears to be no significant difference between the Middle and the Lower Cambrian forms, unless it be in the number of thoracic segments, which in the species here described is unknown.

PAGETIA ELLSI Rasetti, n. sp.

Plate 2, Figs. 13-18.

There is little to distinguish the cranidium of this form from those of certain western species, such as *P. bootes* Walcott and *P. fossula* Resser. The glabella is almost furrowless, tapering and terminates into a slender occipital spine; the occipital furrow is impressed at the sides The fixigenes are most elevated at the palpebral lobes; the small libragenes must have stood almost vertical. In front of the glabella, the fixi-

genes are separated by a wider depression than the narrow longitudinal furrow of *P. bootes* and *P. fossula.* Rim as in the western species, with a row of radial impressions. Genal angles angular but not extended into spines.

Pygidium almost identical with that of *P. fossula.* Axis strongly convex, with five or six distinct segments. There is a tubercle on each segment, and a long, somewhat upturned terminal spine. Pleural lobes strongly convex, unfurrowed.

Length of largest cranidium (exclusive of the spine) 2.5 mm., of pygidium 2 mm.

Holotype and paratypes: Laval Univ. nos. 305 a-m. Lower Cambrian boulders, locality 4.

PAGETIA BILLINGSI Rasetti, n. sp.

Plate 2, Figs. 9-12.

Compared with the preceding species, the cranidium of this form differs in possessing a less tapering glabella, and a more depressed rim.

The pygidium is remarkable for the low axis, which hardly rises above the general convexity of the shield. The axial furrows are faintly indicated on some specimens. The axis terminates into the usual spine.

Holotype and paratypes: Laval Univ. nos. 306 a-c. Lower Cambrian boulders, localities 2 and 4 (types from the former locality).

ORDER UNDETERMINED.

Genus BONNIA Walcott, 1916.

BONNIA sp. undet.

Plate 1, Figs. 20-22.

A few pygidia and an imperfect cranidium of a species of *Bonnia* were recovered from the *Austinvillia* zone. Specific identification is not attempted, as the material is too fragmentary; however, this form is either identical with or exceedingly similar to species that occur in the Forteau and in the equivalent boulders at Bic and other localities.

The glabella has a surface ornamentation consisting of concentric ridges, as often observed in species of *Bonnia.* The posterior part of the cranidium is not preserved.

The pygidium has the structure typical of the genus. On the

outer test, only two faint axial furrows are visible, and the pleural lobes appear practically furrowless. Exfoliated examples show one or two more furrows on the axis, and faint furrows on the pleural lobes.

Laval Univ. nos. 307 a-e. Thin-bedded limestone at locality 1.

Genus AUSTINVILLIA Resser, 1938.

AUSTINVILLIA BICENSIS Resser.

Plate 2, Figs. 1-4.

Austinvillia bicensis Resser, 1938, Geol. Soc. Am. Special Papers, No. 15, p. 61, pl. 3, figs. 6, 7.

Examples of this species occur in both the conglomerate boulders and the thin-bedded limestone of the *Austinvillia* zone.

The specimens were carefully compared with casts of Resser's types, and failed to reveal any significant differences. A few details may be added to Resser's brief description.

Glabella tapering, straight-sided, truncated in front. Three pairs of short, extremely shallow glabellar furrows. Occipital segment obtusely expanded, bearing a small tubercle. Fixigenes rising rather steeply from the dorsal furrows. Ocular ridges wide, made more prominent by the depression of the fixigenes anterior to the eyes; palpebral lobes small but elevated. Anterior facial sutures slightly divergent. Along the anterior margin of the cranidium, the suture is intramarginal on the ventral side, as in several genera of Lower Cambrian trilobites. Whole surface covered with fine granules. Length of largest cranidium 7 mm.

Plesiotypes from Lower Cambrian boulders at locality 4 (Laval University nos. 308 a-d) and from thin-bedded limestone at locality 1 (Laval University nos. 309 a, b.)

Genus PERIOMMA Resser, 1937.

PERIOMMA PUNCTATA Rasetti, n. sp.

Plate 1, Fig. 19.

This species is represented by one imperfect cranidium. Glabella tapering, truncated in front, with three pairs of furrows faintly impressed at the sides. Occipital segment obtusely expanded in the middle. Rim wide, convex; pre-glabellar area narrower than the rim, with a faint boss in the middle. Fixigenes only partly preserved. The most distinctive feature

of this species is the strongly punctate surface of the test. Length of cranidium 6 mm.

Holotype: Laval Univ. no. 310. Thin-bedded limestone at locality 1.

Genus ELLSASPIS Rasetti, n. gen.

The characters of the genus are those of the only known species.

Genotype, *Ellsaspis elliptica*, n. sp.

ELLSASPIS ELLIPTICA Rasetti, n. sp.

Plate 2, Figs. 5-8.

Cranidium subelliptical in shape, twice as wide as long, strongly convex longitudinally and moderately convex transversely. Glabella oval, defined by an extremely faint dorsal furrow on the impression of the lower surface and probably altogether undefined on the upper surface of the test. Glabella occupying about five-sixths of the length and one-third of the width of the cranidium. Glabellar furrows probably wholly absent on the outer surface. On the impression of the lower surface, under proper lighting three pairs of glabellar furrows can be seen in the shape of oval pits; the furrows of the posterior pairs are situated about halfway between the dorsal furrows and the middle of the glabella, those of the anterior pair closer to the dorsal furrows. There also is a small pit in the dorsal furrow at each anterolateral angle of the glabella. Occipital furrow extremely shallow, defining a very narrow occipital segment.

Anterior margin of the cranidium with a narrow, flat rim of even width. Intramarginal furrow well impressed on the posterolateral limbs. The course of the facial sutures cannot be definitely determined from the imperfect material available. It is certain, however, that the libragenes, if any were present, must have been short and narrow, since there is only a short distance between the extremities of the anterior rim and of the posterior intramarginal furrow. The presence of palpebral lobes cannot be definitely ascertained. Surface of test smooth. Length of holotype cranidium 3.5 mm.

An associated pygidium is referred to this species. It is, like the cranidium, rather strongly convex and almost furrowless. The dorsal furrows are faintly indicated on the anterior third.

The writer is unable to suggest the possible affinities of this trilobite. Among Cambrian smooth forms, *Kingstonia* resem-

bles *Ellsaspis* in some respects, but has radically different facial sutures. Among Ordovician trilobites, *Ellsaspis* vaguely resembles certain Illaenids, but the shape of the glabella and of the glabellar furrows is altogether different.

Thin-bedded limestone at locality 3 (Canadian ?).

Holotype and paratypes: Laval University nos. 1250 a-c.

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