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II

No. 11.—NEW LOWER CAMBRIAN SUBFAUNA

(WITH PLATES 50 TO 54)

BY

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(WITH PLATES 50 TO 54)

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INTRODUCTION

During the season of 1912, while making a reconnoissance of a portion of the Robson Peak District north of the Peak I found a block of dark siliceous shale on the surface of Mural Glacier that contained a fine species of *Olenellus* and numerous specimens of a species of *Mickwitzia* and *Lingulella*. The source from which the block came was found in a cliff two miles up the glacier at the foot of Mumm

Peak, which is a high point (9,740 feet=2,968 m.) directly north of Robson Peak. The blocks of shale falling from the cliff had been carried out and down the ice of Mural Glacier. The glacier also passes over the cliff of shale for half a mile to the west. We reached the glacier by climbing up over the cliffs of Mural Brook, which enters Smoky River about a mile (1.6 km.) below the mouth of Calumet Creek. From the foot of the glacier it is about two miles (3.2 km.) up to the base of Mumm Peak. A better way to go is to climb up the mountain side 2,000 feet and cross Hitka Pass, a divide between Mumm Peak and Hitka Mountain. The locality is high up where rain, fog, and snow squalls may be expected nearly every day of the year.

The fauna includes the species described in this paper, also a species of *Planolites* (annelid trail), *Cystid* ? sp. undt., *Hyalithes* sp. undt., and *Hymenocaris* sp. undt. These, with the new species, make up a subfauna in the upper portion of the Lower Cambrian that has not been found elsewhere. It is marked by the absence of *Olenellus canadensis* Walcott and *Protypus fieldensis* Walcott, the typical forms of the upper part of the Lower Cambrian section along Kicking Horse Pass.

There is undoubtedly a larger fauna to be obtained from the *Olenellus truemani* zone, but to find it will require a camp near the locality on Hitka Pass and thorough collecting under adverse conditions.

DESCRIPTION OF SPECIES

MICKWITZIA MURALENSIS, new species

Plate 50, figs. 10, 11; plate 51, figs. 1-6; plate 52, fig. 1

This species differs from *Mickwitzia monilifera* Linnarsson¹ in having a less elevated apex on the ventral valve, a varying position of the apex, and in being in general more transverse.

The shell is built up of several layers of lamellæ that give it thickness and strength. The outer surface is fairly well shown by figure 6, plate 51. It is formed of fine, concentric, minutely undulating and inosculating ridges that are crossed by low, irregular radiating ridges. There is also a pitted appearance resulting from the hollows between the ridges. On many shells there appear to be true punctæ that penetrate through the outer layer of the shell. The inner layers are marked by fine concentric and radiating lines.

¹ Monogr. U. S. Geol. Survey, Vol. 51, 1912, pl. 6, figs. 1, 1a-n.

The largest shell in the collection has a diameter of 46 mm. (pl. 51, fig. 4).

Specimens of the shell are abundant as casts and impressions in the siliceous shale. The original shell has disappeared, but from what we know of the shell of *Mickwitzia monilifera*, it was probably formed of calcium phosphate.

One other American species of *Mickwitzia* is known, *M. occidentis* Walcott.¹ The punctate surface is much like that of *M. muralensis*, but the form as far as known is not similar.

Formation and locality.—Lower Cambrian: (61k) Mahto formation; dark, hard siliceous shale; northeast base of Mumm Peak above Mural Glacier on west side of Hitka Pass, 6 miles (9.6 km.) in a direct line north of the summit of Robson Peak and northwest of Yellowhead Pass, in western Alberta, Canada.

LINGULELLA CHAPA, new species

Plate 50, figs. 4-9

In form this species is not unlike *Lingulella schucherti* (Walcott)² from the Lower Cambrian of New York. It differs in having a more acuminate ventral valve, and possibly in other details not shown by the rather poor specimens of *L. schucherti*. Several species of *Lingulella* from the Upper Cambrian have nearly the same outline of the valves as those of *L. chapa*, notably *L. randomensis* (Walcott)³ and *L. mosia osccola* (Walcott).⁴ Comparison may also be made with the broader forms of *L. perattenuata* (Whitfield).⁵ *Lingulella chapa* is distinguished by the very strong vascular canals of the ventral valve (fig. 6) and the shallow median sinus of the dorsal valve (figs. 4, 8, and 9).

The average length of the ventral valve is from 6 to 7 mm. The dorsal valve is about one-sixth shorter than the ventral.

Specimens of this species occur in such large numbers on partings in the shale as nearly to cover the surface, or they may be scattered about among other brachiopods and fragments of trilobites.

The specific name is taken from Chapa (beaver), the name of the high point at the foot of Mural Glacier where the first specimens of this species were found in a block of shale lying on the glacier.

¹ Monogr. U. S. Geol. Survey, Vol. 51, 1912, p. 331, pl. 6, fig. 4.

² Idem, pl. 21, fig. 6.

³ Idem, pl. 21, figs. 5, 5a.

⁴ Idem, pl. 18, figs. 2, 2a-c.

⁵ Idem, pl. 21, figs. 1c-d.

Formation and locality.—Lower Cambrian (61k) Mahto formation; dark, hard siliceous shale; northeast base of Mumm Peak above Mural Glacier on west side of Hitka Pass, 6 miles (9.6 km.) in a direct line north of summit of Robson Peak and northwest of Yellowhead Pass, in western Alberta, Canada.

LINGULELLA HITKA, new species

Plate 50, figs. 1-3

This species is represented by a number of compressed valves partly flattened in the shale. The outer surface has concentric striæ and lines of growth, and the shell is built up of several layers of what was probably calcareo-corneous material arranged as in typical *Obolinæ*.¹

The average size and appearance of the valves are shown by figure 1, plate 50. A few ventral valves have a length of 13 mm., but the average is about 10 mm.

In outline of valves and general appearance, this species is similar to *Lingulella bella* (Walcott).² It is so highly improbable that a Lower Cambrian species of the Cordilleran sea could persist until the close of Cambrian time in the Atlantic Province that I do not think it advisable to identify the two widely separated forms as belonging to the same species.

There are no Lower Cambrian forms that seem to be similar to *L. hitka*.

The specific name is taken from the Indian name Hitka (brown), a name applied to the mountain that rises on the east side of the ravine in which the specimens of *L. hitka* were found.

Formation and locality.—Lower Cambrian: (61k) Mahto formation; dark, hard siliceous shale; northeast base of Mumm Peak above Mural Glacier on west side of Hitka Pass, 6 miles (9.6 km.) in a direct line north of summit of Robson Peak and northwest of Yellowhead Pass, in western Alberta, Canada.

OBOLELLA NUDA, new species

Plate 52, figs. 3-7

The first impression given by the shells of this species is that they are closely allied to *Obolella atlantica* Walcott.³ They have about the same size and form. They differ in having a flattened median space.

¹ Monogr. U. S. Geol. Survey, Vol. 51, 1912, p. 371.

² Idem, pl. 19, figs. 2, 2a-g; pl. 36, fig. 4.

³ Idem, pl. 55, figs. 1, 1a-i.

occupying a little more than one-third of the surface that extends from the apex of the valves to the front margin. The casts of the interior of the valves show the cardinal area, main vascular sinuses, and the form of the visceral area.

The average size of the valves is from 4 to 6 mm. in diameter.

As far as can be determined from the casts of the valves which are compressed in the shale the shells were thinner than those of *Obolella chromatica* Billings,¹ and had a somewhat different arrangement of the various features of the interior of the valves. The mode of occurrence is much like that of *O. chromatica* and *O. atlantica*, as the valves occur in large numbers on partings of the shale. If specimens can be found in a calcareous deposit, much closer comparison may be made with other species.

Formation and locality.—Lower Cambrian: (6rk) Mahto formation; dark, hard siliceous shale; northeast base of Mumm Peak above Mural Glacier on west side of Hitka Pass, 6 miles (9.6 km.) in a direct line north of summit of Robson Peak and northwest of Yellowhead Pass, in western Alberta, Canada.

OBOLELLA cf. CHROMATICA Billings

Plate 52, fig. 2

Obolella chromatica BILLINGS, 1861. For synonymy see Monogr. U. S. Geol. Survey, Vol. 51, 1912, p. 591.

This form is represented by casts of the exterior and partial interiors of several valves of a shell that is very much like what *O. chromatica* might be if preserved in the same siliceous, shaly matrix. The shell is larger than that of *Obolella nuda* (p. 312) as it averages 8 mm. in diameter, and the valves are evenly convex and not flattened as is the case with *O. nuda*.

Formation and locality.—Lower Cambrian: (6rk) Mahto formation; dark, hard siliceous shale; northeast base of Mumm Peak above Mural Glacier on west side of Hitka Pass, 6 miles (9.6 km.) in a direct line north of summit of Robson Peak and northwest of Yellowhead Pass, in western Alberta, Canada.

HOLMIA ? MACER, new species

Plate 54, fig. 1

This species is characterized by its proportionally large cephalon¹ and narrow thorax, in these respects resembling *Holmia kjerulfi*.²

¹ Monogr. U. S. Geol. Survey, Vol. 51, 1912, p. 591, pl. 54, figs. 1, 1a-i.

² Smithsonian Misc. Coll., Vol. 53, No. 6, 1910, pl. 27, fig. 7.

It differs, however, from the latter in many details of the cephalon and thorax. The cephalon more closely resembles that of *Holmia rozei*¹ in its glabella and strong, rounded marginal border, but it does not have the strong occipital spine of the latter. There are 13 segments of the thorax preserved in the type specimen. The ends of the plural lobe terminate rather abruptly in sharp, backward-pointing spines, in this respect resembling *Holmia kjerulfi*.

Nothing is known of the posterior segments of the thorax or the pygidium.

The type and only specimen of this species was discovered by Professor H. Justin Roddy of the State Normal School, Millersville, Pennsylvania, who presented it to the United States National Museum.

Formation and locality.—Lower Cambrian: (12v) Upper portion of York formation, 2 miles (3.2 km.) north of the city of Lancaster, near Fruitville, Lancaster County, Pennsylvania.

WANNERIA OCCIDENS, new species

Plate 53, fig. 2

Of this species only a single cephalon occurs in the collection. This has the characteristic short palpebral lobe and elongate boss between the latter and the dorsal furrow adjoining the glabella. The sides of the glabella are subparallel opposite the two posterior pairs of glabellar furrows. The margin of the cephalon is broad and slightly rounded. A short occipital spine that is about one-fourth the length of the cephalon projects backward from the center of the occipital ring.

The cephalon differs from that of *Wanneria walcottanus*² in being proportionally more elongate, and in the presence of an occipital spine instead of an occipital node or tubercle.

It differs from *Olenellus gilberti*³ in its small, short palpebral lobe and strong marginal rim, also in the presence of an occipital spine.

The small palpebral lobe and tubercle back of it suggest *Olenellus canadensis*,⁴ but the other parts of the cephalon differ.

Formation and locality.—Lower Cambrian: (6rk) Mahto formation; dark, hard siliceous shale; northeast base of Mumm Peak above Mural Glacier on west side of Hitka Pass, 6 miles (9.6 km.) in a

¹ Smithsonian Misc. Coll., Vol. 53, No. 6, 1910, pl. 29.

² Idem, pl. 30.

³ Idem, pl. 36.

⁴ Idem, pl. 38, figs. 4-6.

direct line north of summit of Robson Peak and northwest of Yellowhead Pass, in western Alberta, Canada.

CALLAVIA EUCHARIS, new species

Plate 53, fig. 1

This fine species is represented by one entire specimen. It has 23 segments in the thorax, and a very small and narrow pygidium. The cephalon is very much like that of *Callavia perfecta*, but the thoracic segments are proportionally narrower and there are six more of them.

The dorsal shield has a length of 38 mm., with a width of 30 mm. at the back of the cephalon.

Traces of the surface show it to have been ornamented with a fine network formed of low, sharp ridges such as is found on most species of the Mesonacidae.

Formation and locality.—Lower Cambrian: (61k) Mahto formation; dark, hard siliceous shale; northeast base of Mumm Peak above Mural Glacier on west side of Hitka Pass, 6 miles (9.6 km.) in a direct line north of summit of Robson Peak and northwest of Yellowhead Pass, in western Alberta, Canada.

CALLAVIA PERFECTA, new species

Plate 53, figs. 3-5

This species recalls *Callavia crosbyi* Walcott.¹ It differs in having a more tapering glabella, smaller palpebral lobes, and in the absence of a strong occipital spine. The cephalon of *Callavia burri* Walcott² is very similar, but, as may be seen by comparing figures 9 and 10 of the latter with figure 5, plate 53, of *Callavia perfecta*, the palpebral lobes are larger and farther out from glabella.

Callavia perfecta has 17 thoracic segments and a very small, narrow pygidium. The exterior surface has a very minute fretwork of lines that is difficult to be seen even with a strong lens, in this respect differing from the associated *Callavia eucharis*.

Formation and locality.—Lower Cambrian: (61k) Mahto formation; dark, hard siliceous shale; northeast base of Mumm Peak above Mural Glacier on west side of Hitka Pass, 6 miles (9.6 km.) in a direct line north of summit of Robson Peak and northwest of Yellowhead Pass, in western Alberta, Canada.

¹ Smithsonian Misc. Coll., Vol. 53, No. 6, 1910, p. 284, pl. 28.

² Idem, pl. 28, figs. 9 and 10.

OLENELLUS TRUEMANI, new species

Plate 54, figs. 2-10

This species differs from *Olenellus thompsoni* (Hall)¹ and *O. gilberti* Meek² in having shorter palpebral lobes and eyes, smaller and shorter plural lobes of the third thoracic segment, and in having a more coarsely reticulated outer surface of the test, in the latter character resembling *O. reticulatus* Peach.³ It differs from the latter and *O. lapworthi* Peach⁴ in having a stronger rim about the cephalon, the anterior glabellar lobe closer to the frontal rim, and a broader thorax and smaller, shorter pleural lobe on the third segment. The third thoracic segment is distinctly larger than the others in all specimens; proportionally it decreases in size from the young to the largest adults, as may be seen by comparing figure 10 and figure 2, plate 54.

The hypostoma has a denticulated posterior margin similar to that of *Pædeumias transitans*⁵ and *Wanneria halli*.⁶ It appears to have been attached to the doublure by its anterior margin and not by a process as in *Pædeumias transitans*.

The specimens of this species are abundant and usually well preserved. The largest cephalon collected has a width of 50 mm. and a length of 22 mm., and the entire dorsal shield has a length of 56 mm. exclusive of the spine-like telson.

The specific name is given in memory of Dr. J. M. Trueman, of the Geological Survey of Canada, a most promising young geologist who was drowned in a canoe accident that occurred (June 24, 1912) while he was showing me the Huronian fossil-bearing limestones of Steeprock Lake, Ontario, Canada.

Formation and locality.—Lower Cambrian: (61k) Mahto formation; dark, hard siliceous shale; northeast base of Mumm Peak above Mural Glacier on west side of Hitka Pass, 6 miles (9.6 km.) in a direct line north of summit of Robson Peak and northwest of Yellowhead Pass, in western Alberta, Canada.

¹ Smithsonian Misc. Coll., Vol. 53, No. 6, 1910, pl. 35.

² Idem, pl. 36.

³ Idem, pl. 39.

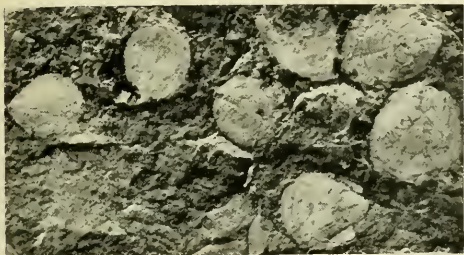
⁴ Idem, pl. 39.

⁵ Idem, pl. 34, fig. 8.

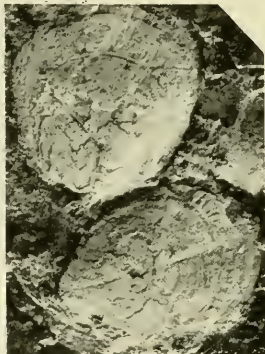
⁶ Idem, pl. 31, fig. 9.

DESCRIPTION OF PLATE 50

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| FIG. 1. (Natural size.) Group of shells flattened on surface of shale.
(Locality 61k.) U. S. National Museum, Catalogue No. 60067. | |
| 2. (× 2.) A ventral and a dorsal valve enlarged from fig. 1. | |
| 3. (× 2.) A dorsal valve that occurs on fig. 1. | |
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U. S. National Museum, Catalogue No. 60068. | |
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U. S. National Museum, Catalogue No. 60069. | |
| 6. (× 4.) Natural matrix of the interior of a ventral valve.
(Locality 61k.) U. S. National Museum, Catalogue No. 60070. | |
| 7. (× 4.) A partly exfoliated ventral valve. (Locality 61k.)
U. S. National Museum, Catalogue No. 60071. | |
| 8. (× 4.) A small, uncompressed dorsal valve. (Locality 61k.)
U. S. National Museum, Catalogue No. 60072. | |
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| 11. (× 6.) Area about apex and posterior margin enlarged to illustrate surface character. (Locality 61k.) U. S. National Museum, Catalogue No. 60094. | |
| <p>The specimens represented by figs. 1-11 are from locality 61k. Lower Cambrian: Mahto formation; dark, hard siliceous shale, northeast base of Mumm Peak above Mural Glacier on the west side of Hitka Pass, 6 miles (9.6 km.) in a direct line north of summit of Robson Peak and northwest of Yellowhead Pass, in western Alberta, Canada.</p> | |



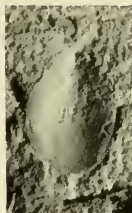
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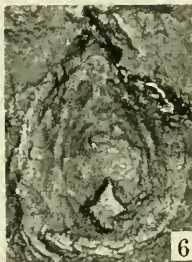
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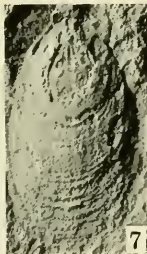
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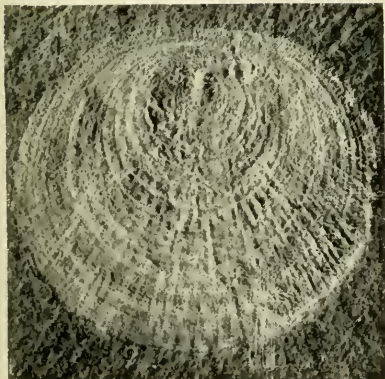
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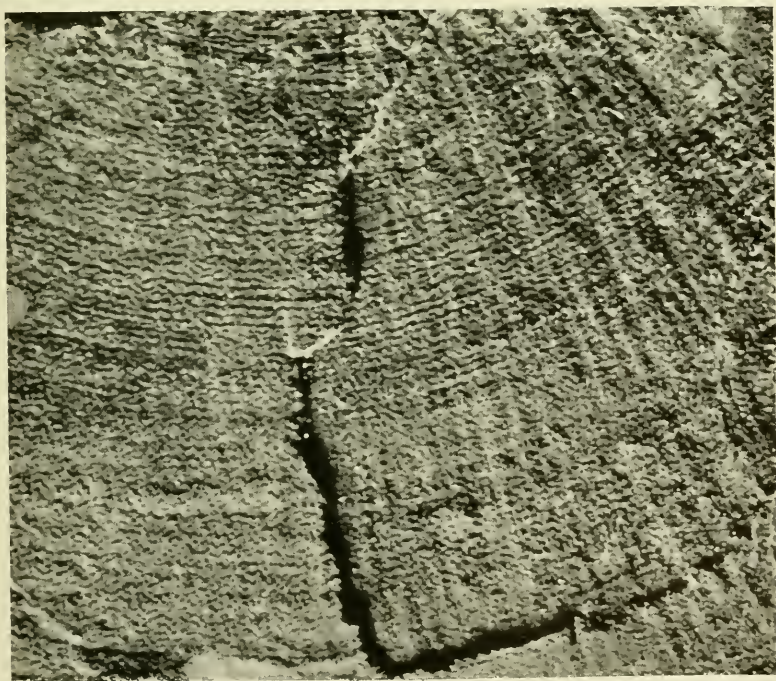
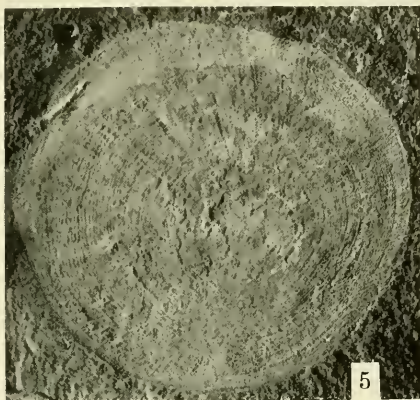
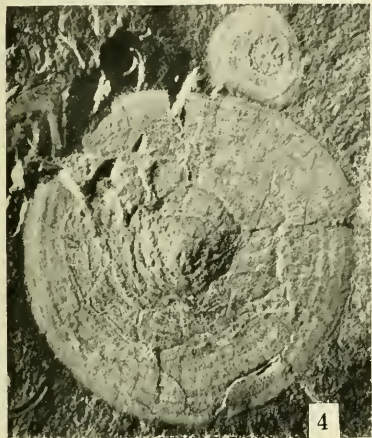
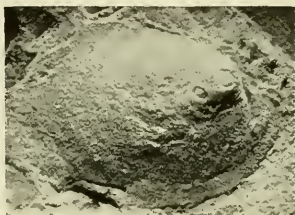
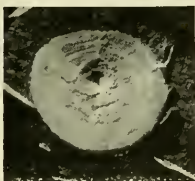


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DESCRIPTION OF PLATE 51

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<i>Mickwitzia muralensis</i> Walcott. (See Plates 50 and 52).....	310
FIG. 1. (× 2.) Small ventral valve with submarginal apex. (Locality 61k.) U. S. National Museum, Catalogue No. 60095.	
2. (Natural size.) Small ventral valve with apex nearly at its center. (Locality 61k.) U. S. National Museum, Catalogue No. 60096.	
3. (× 3.) Ventral valve preserving much of its original convexity. (Locality 61k.) U. S. National Museum, Catalogue No. 60097.	
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6. (× 8.) Enlargement of exterior surface of a ventral valve. (Locality 61k.) U. S. National Museum, Catalogue No. 60100.	

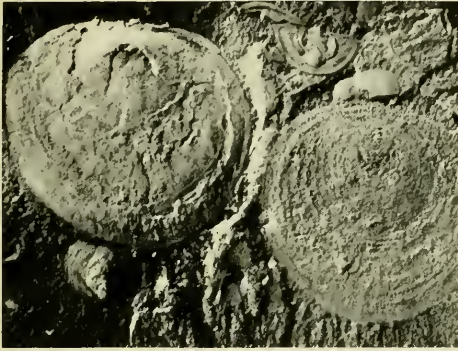
The specimens represented by figs. 1-6 are from locality 61k. Lower Cambrian: Mahto formation; dark, hard siliceous shale, northeast base of Mumm Peak above Mural Glacier on the west side of Hitka Pass, 6 miles (9.6 km.) in a direct line north of summit of Robson Peak and northwest of Yellowhead Pass, in western Alberta, Canada.



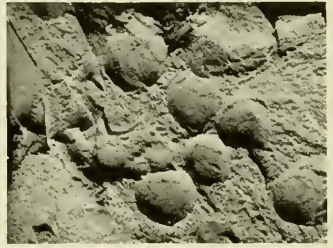
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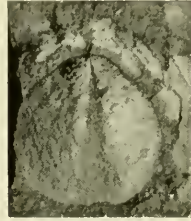
The specimens represented by figs. 1-7 are from locality 61k. Lower Cambrian: Mahto formation: dark, hard siliceous shale, northeast base of Mumm Peak above Mural Glacier on the west side of Hitka Pass, 6 miles (9.6 km.) in a direct line north of summit of Robson Peak and northwest of Yellowhead Pass, in western Alberta, Canada.



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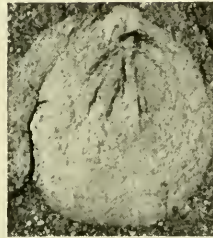
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DESCRIPTION OF PLATE 53

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FIG. 1. (X 2.) Type specimen of the species. (Locality 6rk.) U. S. National Museum, Catalogue No. 60079.	
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4. (Natural size.) Specimens of the cephalon found in a parting of the shale. (Locality 6rk.) U. S. National Museum, Catalogue No. 60082.	
5. (Natural size.) A large cephalon flattened in the shale. (Locality 6rk.) U. S. National Museum, Catalogue No. 60083.	

The specimens represented here by figs. 1-5 are from locality 6rk. Lower Cambrian: Mahto formation; dark, hard siliceous shale, northeast base of Mumm Peak above Mural Glacier on the west side of Hitka Pass, 6 miles (9.6 km.) in a direct line north of summit of Robson Peak and northwest of Yellowhead Pass, in western Alberta, Canada.



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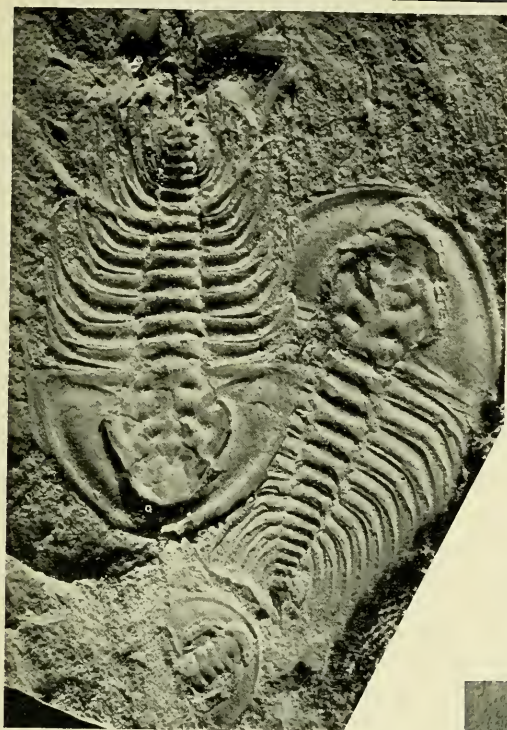
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TRILOBITA

DESCRIPTION OF PLATE 54

	PAGE
<i>Holmia ? macer</i> Walcott	313
FIG. 1. (× 3.) Type specimen of the species. (From locality 12v.) Lower Cambrian shale, Fruitville, Lancaster County, Penn- sylvania. U. S. National Museum, Catalogue No. 60092.	
<i>Olenellus truemani</i> Walcott	316
FIG. 2. (× 2.) Surface of shale with two compressed, nearly entire dorsal shields and a small cephalon. (Locality 61k.) U. S. National Museum, Catalogue No. 60084.	
3. (× 2.) Compressed and slightly distorted hypostoma. (Local- ity 61k.) U. S. National Museum, Catalogue No. 60085.	
4 and 5. (× 5.) Two small hypostomas. (Locality 61k.) U. S. National Museum, Catalogue No. 60086.	
6. (Natural size.) Cephalon with outer test of cheeks exfoliated so as to show casts of radial canals. (Locality 61k.) U. S. National Museum, Catalogue No. 60087.	
7. (Natural size.) Broad, flattened dorsal shield with enlarged third thoracic segment. (Locality 61k.) U. S. National Museum, Catalogue No. 60088.	
8. (× 2.) A small, almost entire dorsal shield. (Locality 61k.) U. S. National Museum, Catalogue No. 60089.	
9. (× 2.) A small cephalon preserving much of its original con- vexity. The attached thoracic segments are more or less displaced. (Locality 61k.) U. S. National Museum, Cata- logue No. 60090.	
10. (× 2.) Small, nearly entire, undistorted dorsal shield with large third thoracic segment. (Locality 61k.) U. S. National Museum, Catalogue No. 60091.	

The specimens represented by figs. 2-10 are from locality 61k. Lower Cambrian: Mahto formation; dark, hard siliceous shale, northeast base of Mumm Peak above Mural Glacier on the west side of Hitka Pass, 6 miles (9.6 km.) in a direct line north of summit of Robson Peak and northwest of Yellowhead Pass, in western Alberta, Canada.



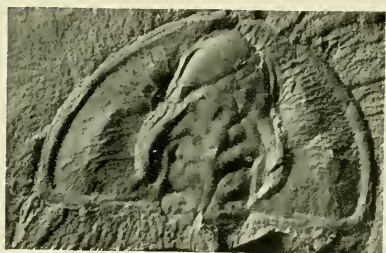
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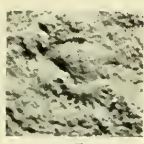
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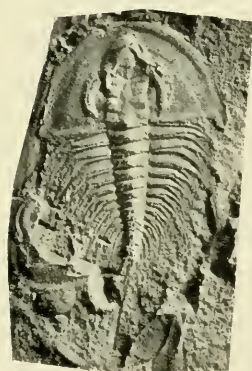
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TRILOBITA