SMITHSONIAN MISCELLANEOUS COLLECTIONS
VOLUME 101, NUMBER 15

FIFTH CONTRIBUTION TO NOMENCLATURE OF CAMBRIAN FOSSILS

BY
CHARLES E. RESSER
Curator, Division of Stratigraphic Paleontology
U. S. National Museum

(PUBLICATION 3682)

CITY OF WASHINGTON
PUBLISHED BY THE SMITHSONIAN INSTITUTION
MAY 22, 1942

SMITHSONIAN MISCELLANEOUS COLLECTIONS
VOLUME 101, NUMBER 15

FIFTH CONTRIBUTION TO NOMENCLATURE OF CAMBRIAN FOSSILS

BY
CHARLES E. RESSER
Curator, Division of Stratigraphic Paleontology
U. S. National Museum

(PUBLICATION 3682)

CITY OF WASHINGTON
PUBLISHED BY THE SMITHSONIAN INSTITUTION
MAY 22, 1942

The Lord Baltimore Press
BALTIMORE, MD., U. S. A.

FIFTH CONTRIBUTION TO NOMENCLATURE OF CAMBRIAN FOSSILS

By CHARLES E. RESSER

Curator, Division of Stratigraphic Paleontology,
U. S. National Museum

This is the fifth in the series of papers designed to care for changes necessary in the names of Cambrian fossils. When the fourth[1] paper was published it was hoped that further changes would be so few and so obvious that they could be incorporated in the Cambrian bibliographic summary, and would not be required to appear first in a separate paper. But even now it is impossible to gather all of the known errors for rectification in this paper. For example, correction of some errors must await the opportunity to examine the specimens because the published illustrations, obviously showing incorrect generic determinations, are too poor to permit a proper understanding of the fossil. In the other instances where new generic designations are clearly indicated, erection of new genera should await the publication of a paper with illustrations, because better-preserved specimens are in hand, or undescribed species portray the generic characteristics more fully and should therefore be chosen as the genotypes. And finally, still other incorrectly placed species cannot be reassigned until better-preserved specimens are found.

Certain changes contained in this paper have arisen from revision of genera during the description of new species. It is common experience that when new species are added to a genus, regardless of whether it originally was monotypic or contained many species, its concept changes. As further species are added, it often becomes clear that earlier assignments were made on family rather than generic characteristics. For this reason many genera need revision from time to time.

The second source of changes lies in the erroneous interpretations contained in certain recent papers describing Cambrian fossils. In

[1] Resser, Charles E., Nomenclature of some Cambrian trilobites, Smithsonian Misc. Coll., vol. 93, No. 5, Feb. 14, 1935; Second contribution to nomenclature of Cambrian trilobites, ibid., vol. 95, No. 4, Apr. 1, 1936; Third contribution to nomenclature of Cambrian trilobites, ibid., vol. 95, No. 22, Apr. 5, 1937; Fourth contribution to nomenclature of Cambrian fossils, ibid., vol. 97, No. 10, Dec. 17, 1938.

late years a great many papers dealing with Cambrian stratigraphy and paleontology have appeared, and more persons are writing in this field. Naturally many important facts have been brought to light and a considerable number of new species described. Many of these papers are excellent, but in some the quality of work leaves much to be desired, and for years to come it will be necessary to rectify errors and misinterpretations, many of which could have been avoided.

Numerous species from Asia are included in this paper. Studies during the past several years, involving Asiatic species, brought to light the degree to which workers dealing with Asiatic Cambrian fossils have been handicapped by unavailability of comparative material. Also, it must be remembered that nearly all work was in virgin territory. Even now only a beginning can be made in the revision of Asiatic Cambrian nomenclature. Many hundreds of new species are in hand, and they will, without doubt, throw much light on the significance of described genera and bring out many new ones. The purpose of making some of the needed changes affecting Asiatic species at this time is to attempt to forestall other mistakes by calling attention to existing ones. Only those changes have been made which could be based on specimens available to me, or which were perfectly obvious from published illustrations.

Certain nomenclatural changes for brachiopods were included in the first draft of this manuscript. However, it was soon discovered that several hundred changes and restrictions of species are necessary, which it is hoped may be done by someone else.

NOTE ON STATUS OF CLASSIFICATION OF TRILOBITES

Twenty-five years ago it was generally believed that Cambrian trilobite classification was fairly satisfactory and complete, except for a few unplaced genera. However, those who were familiar with the national collections at that time, knew that only a small proportion of the species on hand had been described. Furthermore, those then familiar with the Cambrian system also knew that many areas of outcrop had not yet been explored and were sure to yield large collections.

Ulrich discussed this question in 1929, and the arguments he then used are still pertinent in spite of the greatly increased number of species since described. Today there are still too many undescribed species on hand to warrant the erection of a classification intended to embrace the whole of the class.

In recent years several more or less general classifications have been attempted. In 1927 Poulsen discussed Beecher's orders and

briefly considered the major trilobite families, particularly with reference to the Cambrian genera. At that time he changed Swinnerton's (1915) suborder Mesonacida (Olenellida) to an order, removing this group from the Opisthoparia. He then suggested two orders to embrace the remaining trilobite genera, the Integricephalida and the Suturicephalida, the latter possibly to include Beecher's Opisthoparia and Proparia as suborders. At the same time Poulsen set up some new trilobite families, subsequent modification of which resulted from two causes: First, the stratigraphic position of some of Poulsen's material could not then be determined accurately, and consequently he was unable to tell the relative ages of the genera; second, addition of numerous species—often with better-preserved material—has altered and enlarged the concept of several genera; with the result that some of the families had to be subdivided. Time will tell whether it is going to be desirable to use Poulsen's classification further.

Lorenz (1906) based a partial classification on porosity and granulosity of the test, characters which appear to have no value in this connection.

Swinnerton (1915) reviewed and criticized the classifications of Gürich (1907) and Jaekel (1909), and gave one of his own. Gürich based his classification on the number of free segments and size of the pygidium, which, as Swinnerton states, are progressive characters and hence valueless for this purpose. He also called attention to the fact that Jaekel removed the agnostids from the trilobites because of their few segments. Swinnerton then proposed another grouping, in which he recognized several suborders within Beecher's Opisthoparia and Proparia. Subsequent authors have not followed Swinnerton, although it appears that his suggestions have merit.

In 1935 Kobayashi reviewed previous classifications, adopted a new one, and classified chiefly the Cambrian genera. He did not carry his work to completion, hence it is not possible to determine precisely what orders he had in mind. For the Cambrian genera mainly, he recognized five suborders, and set up numerous additional families, many of which must be revised, because he depended too much on similarity in appearance as expressing relationship. Moreover, he frequently failed to give due consideration to stratigraphic position, or relative age of genera. Naturally, many of the new families are valid and serve a useful purpose, but the work as a whole evidences the haste with which it was done.

Since Jaekel stressed the difference between the agnostids and trilobites, most authors have been inclined to follow him. In 1934

Howell and Resser proposed the recognition of the agnostids as an order, in which they were followed by Kobayashi (1935, 1939). In the latter year Kobayashi attempted a classification of the entire group of agnostids. Unfortunately it is necessary to call attention to the fact that much of Kobayashi's 1939 paper was copied, without permission, from the manuscript being prepared by Howell and myself. It, therefore, reflects our views up to the time when the particular portions of the manuscript were written, but in many instances we no longer hold strictly to those views.

It is my idea that the agnostids constitute a subclass, holding equal rank with Trilobita and other recognized subclasses of the Crustacea. I also consider the Olenellida as an order, but have no final opinion of the value of the remaining Beecher orders.

Thanks are due Prof. G. M. Ehlers, University of Michigan, for loan of Rominger's types. The attempt was made to ascertain every type specimen among the material left by Rominger in an unmarked condition. Some figures are no doubt composite, but others could be recognized, as discussed on subsequent pages.

TRILOBITA

ALOKISTOCARE Lorenz, 1906

Alokistocare brighamense, new species

Alokistocare laticaudum Resser (part), Smithsonian Misc. Coll., vol. 97, No. 12, p. 17, pl. 4, fig. 15, 1939.

When *A. laticaudum* was described the nontypical form of one cranidium was noted. However, study of the series of species from Two Mile Canyon was required to define clearly both *A. laticaudum* and the new species. It is not yet certain that the other specimen assigned to *A. laticaudum* from the Wasatch Mountains near Brigham can remain in the species.

The holotype cranidium of *A. brighamense* is very close to *A. euchare* Resser from Two Mile Canyon. It differs from *A. laticaudum* in its narrower brim.

A. brighamense is characterized by a slender tapering glabella occupying about half the cranidial length. The usual furrows are present. Brim wide, concave, with a nearly semicircular anterior outline. The fixigenes are wider than the glabella. The eyes are small, situated behind the midpoint of the glabella, so that the eye lines slope back rather sharply.

Middle Cambrian, Spence; (loc. 55e) 4½ miles north of Brigham, Wasatch Mountains, Utah.

Holotype.—U.S.N.M. No. 102325.

AMPHOTON Lorenz, 1906

Amphoton blackwelderi, new species

Dolichometopus deois WALCOTT (part), Research in China, vol. 3, Carnegie Inst. Washington Publ. 54, p. 216, pl. 22, fig. 1h, 1913.

This species is larger than the average for the genus. Unfortunately, the cranidium was not illustrated, although several examples are present in the material with the holotype pygidium. Compared with *A. asiaticum* and *A. deois,* this cranidium is characterized by its smoothness and the presence of a rather short but prominent occipital spine. The holotype pygidium is smoother than that of the other species, and the axis is relatively somewhat shorter. While the pleural ribs are not much more prominent than in the other species, they appear to be sharper and narrower owing to the abrupt slope into the furrows, but when viewed from the side or the rear they seem to be much less prominent. The axis does not stand very high above the pleural platforms and slopes off more gently in the rear.

Middle Cambrian, Changhia; (loc. C4) 3 miles southwest of Yenchuang, Sintai district, Shantung, China.

Holotype.—U.S.N.M. No. 58248; paratypes, No. 60832.

Amphoton alceste (Walcott)

Dolichometopus alceste WALCOTT, Proc. U. S. Nat. Mus., vol. 29, p. 94, 1905; Research in China, vol. 3, Carnegie Inst. Washington Publ. 54, p. 215, pl. 22, figs. 3-3b, 1913.

Middle Cambrian, Changhia; (locs. C4, C1) southwest of Yenchuang, Sintai district, Shantung, China.

Holotype.—U.S.N.M. No. 58249; paratypes, Nos. 58250, 58251.

Amphoton kaipingense, new species

Dolichometopus deois SUN, Geol. Surv. China, Pal. Sinica, ser. B, vol. 1, fasc. 4, p. 81, pl. 5, fig. 9, 1924.

This smooth cranidium cannot belong with the furrowed *A. deois* or *A. asiaticum.* Its glabella is relatively shorter (disregarding Walcott's incorrect drawings).

Middle Cambrian, Nanchuang; Kwang-hsi-ying, Luanchou, Kaiping basin, Chihli, China.

Holotype.—Geol. Surv. China No. 623.

Amphoton hyrie (Walcott)

Dolichometopus hyrie WALCOTT, Proc. U. S. Nat. Mus., vol. 30, p. 594, 1906; Research in China, vol. 3, Carnegie Inst. Washington Publ. 54, p. 218, pl. 22, figs. 6-6b, 1913.

Middle Cambrian, Changhia; (loc. C69) 4 miles east of Fanglan-chön, Shansi, China.

Holotype.—U.S.N.M. No. 58257; paratypes, Nos. 58258, 58259.

ANOMOCARELLA Walcott, 1905

Anomocarella shantungensis, new species

Anomocarella chinensis WALCOTT (part), Research in China, vol. 3, Carnegie Inst. Washington Publ. 54, p. 200, pl. 20, fig. 3b, 1913.

This species is like *A. chinensis* in every respect except the structure of the brim. In *A. shantungensis* the preglabellar area has about the same proportions, convexity, and slope as in *A. chinensis,* but the rim is considerably wider.

Middle Cambrian, Changhia; (loc. C57) 4 miles north of Sintai; and (loc. C4) 3 miles southwest of Yenchou, Shantung, China.

Holotype.—U.S.N.M. No. 58207.

AOJIA Resser and Endo, 1935

Aojia biston (Walcott)

Anomocare biston WALCOTT, Proc. U. S. Nat. Mus., vol. 29, p. 49, 1905.

Anomocarella biston WALCOTT, Research in China, vol. 3, Carnegie Inst. Washington Publ. 54, p. 198, pl. 21, fig. 2, 1913.

Middle Cambrian, Changhia; (loc. C2) 2 miles south of Yenchuang, Shantung, China.

Holotype.—U.S.N.M. No. 58201.

Aojia undata (Walcott)

Ptychoparia undata WALCOTT, Proc. U. S. Nat. Mus., vol. 30, p. 589, 1906.

Anomocarella undata WALCOTT, Research in China, vol. 3, Carnegie Inst. Washington Publ. 54, p. 210, pl. 21, fig. 5, 1913.

Middle Cambrian, Changhia; (loc. C71) 4 miles southwest of Tungyü, Shansi, China.

Holotype.—U.S.N.M. No. 58202.

ASIOPTYCHASPIS Kobayashi, 1933

Asioptychaspis shansiensis (Sun)

Ptychaspis shansiensis SUN, Geol. Surv. China, Pal. Sinica, ser. B, vol. 7, fasc. 2, p. 29, pl. 4, figs. 1-6, text fig. 3, 1935.

Upper Cambrian, Licheng; Shangyaocheng, Licheng, Shansi, China.

Cotypes.—Nat. Peiping Univ. Nos. S1202-S1208.

Asioptychaspis brevica (Sun)

Ptychaspis brevicus SUN, Geol. Surv. China, Pal. Sinica, ser. B, vol. 7, fasc. 2, p. 28, pl. 4, figs. 7-9, 1935.

Upper Cambrian, Wolungshan; Huolu, Hopei, China.

Cotypes.—Nat. Peiping Univ. Nos. S1209-S1211.

Asioptychaspis asiatica (Resser and Endo)

"Ptychaspis" asiatica Resser and Endo, Manchurian Sci. Mus. Bull. 1, pt. 2, p. 272, pl. 56, figs. 4-9, 1937.

Upper Cambrian, Yenchou (*Asioptychaspis* zone); Shang-ping-chou, 8 miles east of Liao-yang and at Yen-chou-chang, 4.5 miles south of Yentai, Taitzuho district, Manchoukuo.

Cotypes.—U.S.N.M. Nos. 86895, 86896.

Asioptychaspis chihliensis Resser

Ptychaspis subglobosa Sun (part), Geol. Surv. China, Pal. Sinica, ser. B, vol. 7, fasc. 2, p. 28, pl. 4, figs. 10, 11, 1935.

Upper Cambrian, Taoyuan; Ting-chia-tsun, western hills of Peiping, Chihli, China.

Cotypes.—Nat. Peiping Univ. Nos. S1212, S1213.

Asioptychaspis suni (Grabau)

Ptychaspis suni Grabau, *in* Sun, Geol. Soc. China, Bull. 2, Nos. 1-2, p. 98, 1923; *in* Sun, Geol. Surv. China, Pal. Sinica, ser. B, vol. 1, fasc. 4, p. 75, pl. 5, figs. 4a, 4b, 1924.

Upper Cambrian, Fengshan; Yehli, Hopei, China.

Holotype and paratype.—Geol. Surv. China No. 609.

Asioptychaspis sphaerica (Resser and Endo)

Ptychaspis sphaerica Resser and Endo, *in* Endo, Iwanami Lecture Ser., Geol. Pal., p. 89, text figs. 10-13, December 1931; Manchurian Sci. Mus. Bull. 1, pt. 2, p. 273, pl. 55, figs. 10-13, 1937.

Upper Cambrian, Yenchou; slope of Paishan near Chinchia-chengtzu, Manchoukuo.

Cotypes.—U.S.N.M. No. 86897.

BERKEIA Resser, 1937

Berkeia affinis (Walcott)

Ptychoparia (Eutoma?) affinis Walcott, U. S. Geol. Surv. Monogr. 8, p. 54, pl. 10, fig. 12, 1884; idem, 32, p. 457, pl. 65, fig. 8, 1899.

Iddingsia affinis Resser, Smithsonian Misc. Coll., vol. 95, No. 22, p. 14, 1937.

Recently a large number of Upper Cambrian specimens and species have been photographed and described preparatory to publication. One of the groups thus investigated is *Iddingsia-Berkeia-Dokimocephalus-Burnetia*. Now that a number of species are known in each, it is possible to set more natural limits to the genera.

Upper Cambrian, Dunderberg; (loc. 63) northeast of Adams Hill, Eureka district, Nevada.

Holotype.—U.S.N.M. No. 24642.

BLOUNTIA Walcott, 1916

Blountia arguta, new species

Maryvillia arion WALCOTT (part), Smithsonian Misc. Coll., vol. 64, No. 5, p. 400, pl. 64, figs. 4a, c, 1916; RESSER, Geol. Soc. Amer. Spec. Pap. 15, p. 87, pl. 13, fig. 9, 1938.

The pygidia removed from *Maryvillia arion* are the basis for this species. About 10 specimens are in hand, but the cranidium has not been located among the lot containing the pygidia. All of the specimens are exfoliated so that axial and pleural furrows are visible. There is so little depression or change of slope at the inner edge of the border that it is doubtful whether the test showed any trace of furrows. This pygidium is not highly arched in either direction, although it is rather evenly convex in all parts, except in the front center.

Upper Cambrian, Nolichucky; (loc. 123b) ½ mile east of Rogersville, Tennessee.

Holotype.—U.S.N.M. No. 62827; paratypes, Nos. 62828, 94968.

Blountia terranovica, new species

Maryvillia arion LOCHMAN, Journ. Pal., vol. 12, No. 5, p. 469, pl. 57, fig. 4, 1938.

The illustration of this pygidium shows that the Newfoundland species has a shorter, wider tail than *B. arion,* with a shorter, less-tapered axis. Judging from the illustrations *B. terranovica* has a rather strong dorsal furrow, and if the specimen is not exfoliated, the anterior pleural and marginal furrows are also clearly defined.

Upper Cambrian, Petit Jardin; south shore of Cape St. George, Newfoundland.

Holotype.—Yale Peabody Mus. No. 15821.

Blountia widnerensis, new species

Maryvillia masadensis RESSER (part), Geol. Soc. Amer. Spec. Pap. 15, pl. 12, fig. 40, 1938.

Only the figured pygidium is in hand from loc. 22n, but from the other locality an excellent cranidium accompanies several pygidia.

The glabella is large, smooth, tapered to a rounded front, and stands above the dorsal furrow. Occipital furrow so faint as to be visible only in strong cross light. Opposite the eye the fixigenes are less than a fifth the glabellar width. Forward of the eye the facial suture diverges somewhat and rounds the anterior angle, remaining intramarginal possibly nearly to the center. Eyes rather small and situated well forward. Behind the eyes the facial suture diverges rapidly, forming posterolateral limbs that exceed the width of the glabella at the neck ring. These limbs turn rather sharply backward in their

outer portion. Since their width decreases gradually, this backward direction is attained by the flexure of the rear margin. The brim width equals about one-fourth of the glabellar length. As a whole it is concave, owing to the depression of the preglabellar area and the more nearly horizontal position of the rim. Viewed in light coming directly from the front, the preglabellar area appears to be about one-third the width of the rim, but when the light comes from the sides, the rim seems to be so wide in the middle that the preglabellar area is destroyed. This illusion is due to the depression of the medial portion of the preglabellar area. Taken as a whole, the cranidium has its maximum convexity in the rear portion, but since the anterior part, although curved little in itself, slopes downward sharply, the convexity of the whole is thereby greatly accentuated. In cross section the cranidium is evenly convex.

Little need be said about the pygidium, since it is normal in all respects. It is moderately convex and in the rear comes to a fairly sharp angle.

Upper Cambrian, Nolichucky; (loc. 22n) Widner Branch, 1½ miles southwest of Masada, and (loc. 35s) 4 miles northeast of Abingdon, Virginia.

Holotype.—U.S.N.M. No. 102311; paratypes, No. 102312.

Blountia antecepta, new species

Maryvillia georgica RESSER (part), Geol. Soc. Amer. Spec. Pap. 15, p. 88, pl. 12, fig. 42, 1938.

In this instance only the pygidia were located. They are typical in all respects, but owing to compression of the rock are nearly flat. Considerable calcite veining also distorts them slightly.

Upper Cambrian, Nolichucky; (loc. 96x) 1 mile north of Adairsville, Georgia.

Holotype.—U.S.N.M. No. 102313.

Blountia angustata, new species

Maryvillia ariston WALCOTT (part), Smithsonian Misc. Coll., vol. 64, No. 5, p. 401, pl. 64, fig. 5a, 1916; RESSER (part), Geol. Soc. Amer. Spec. Pap. 15, p. 87, pl. 13, figs. 4, 6, 1938.

This species is close to *B. arguta*. Walcott recognized a difference which seems to hold for all specimens. The main difference distinguishing *B. angustata* is the narrowing of the tail. Also the rear margin becomes more angular, and at the same time has greater convexity near the edge.

Upper Cambrian, Nolichucky; (locs. 119, 120) Copper Ridge, about 11 miles northwest of Knoxville, and (loc. 126a) Gap Creek, 10 miles east of Knoxville, Tennessee.

Holotype.—U.S.N.M. No. 94997; paratype, No. 62830.

BRISCOIA Walcott, 1924

Briscoia winchelli, new species

Dicellocephalus minnesotensis WINCHELL (part), Amer. Journ. Sci., vol. 37, p. 229, 1864.

Dicellocephalus pepinensis WINCHELL (part), idem.

Dikelocephalus ? limbatus WALCOTT (part), Smithsonian Misc. Coll., vol. 57, No. 13, p. 369, pl. 65, fig. 8, 1914.

This species is represented rather abundantly in the collections at present available. Cranidia are seldom complete. Winchell's material contains the anterior half of a cranidium, and the Whitfield collection at the University of California has a nearly complete example. Pygidia and libragenes are rather well represented.

This species is characterized by normal development in all its parts. The glabella is large, although it maintains normal proportions. It stands above the dorsal furrow and is marked by three sets of furrows. (It must be remembered that only exfoliated specimens are available in sandstone matrix.) The brim is simple, slightly concave and about half the glabellar length. The fixigenes are confined practically to the palpebral lobes since the facial suture cuts close to the dorsal furrow at the anterior end of the eye. From that point forward the suture diverges rather rapidly forming large anterior angles. Behind the eye the suture forms the long, narrow posterolateral limbs characteristic of the genus. The eyes are strongly bowed and are situated well toward the rear. The libragene is wide and has a wide, slightly concave border that extends into short genal spines. A wide doublure underlies the border and leaves only small triangular ocular platforms.

The pygidium on which the species is based is characterized by a slender axis, which occupies a little more than half the pygidial length. At least four rings are visible. The axis terminates in a postaxial ridge. The pleural lobes extend into a wide flaring, slightly concave border. Both the pleural furrows and grooves extend out nearly to the edge of the tail. They subdivide the pleura nearly equally.

Upper Cambrian, Franconia; (loc. 81b) near Devils Lake, Sauk County, Wisconsin.

Holotype.—U.S.N.M. No. 58625; paratypes, Univ. Michigan Nos. 4876, 4873.

CAMARASPIS Ulrich and Resser, 1924

Camaraspis cushingi (Ruedemann)

Agraulos cushingi RUEDEMANN (part), New York State Mus. Bull., No. 189, p. 89, pl. 30, figs. 1, 2, 4, 1916.

Upper Cambrian, Potsdam (Theresa member); Greenfield, northwest of Saratoga, New York.

Lectotype and paratype.—N.Y.S.M. No. 3658; casts, U.S.N.M. No. 102314.

Camaraspis ruedemanni, new species

Agraulos cushingi RUEDEMANN (part), New York State Mus. Bull. No. 189, p. 89, pl. 30, fig. 3, 1916.

In New York, as generally happens elsewhere, several species of *Camaraspis* are found together. Most of Ruedemann's specimens belong to *C. cushingi,* which is rather convex in both directions, but one of the figured cranidia is much flatter longitudinally and has the glabella less clearly defined (drawing misleading). Furthermore, the glabella also is shorter. *C. ruedemanni* has rather sharply depressed posterolateral limbs which arches the cranidium in the rear.

Occurrence same as preceding.

Holotype.—N.Y.S.M.; cast, U.S.N.M. No. 102315.

CHARIOCEPHALUS Hall, 1863

Chariocephalus gibbsi (Whitfield)

Conocephalites gibbsi WHITFIELD (part), Ann. Rep. Wisconsin Geol. Surv., vol. 2, p. 67, 1873-1877.

Crepicephalus gibbsi WHITFIELD (part), Ann. Rep. Wisconsin Geol. Surv. for 1879, p. 50, 1880; (part), Geol. Wisconsin, vol. 4, p. 184, pl. 10, fig. 13, 1882.

Ptychoparia gibbsi WALCOTT (part), Smithsonian Misc. Coll., vol. 64, No. 3, p. 204, 1916.

Upper Cambrian, Franconia; (loc. 86W.), Berlin, Wisconsin.

Holotype.—Wisconsin Acad. Sci.; cast, U.S.N.M. No. 108496.

CHUANGIA Walcott, 1911

Chuangia endoi, new name

Chuangia nitida ENDO, Manchurian Sci. Mus. Bull. 1, pt. 3, p. 325, pl. 67, fig. 1, 1937.

This is not conspecific with *Chuangia nitida* Walcott, which is equivalent to *C. buchrucheri.*

Upper Cambrian, Paishan; Tang-shih-ling hill, southeast of Yentai colliery, Manchoukuo.

Holotype.—Manchurian Sci. Mus. No. 1322.

Chuangia monkei (Lorenz)

Schantungia monkei LORENZ, Deutsch. Geol. Ges. Zeitschr., vol. 58, No. 2, p. 81, pl. 5, figs. 17, 18, 1906.

Schantungia crassa LORENZ, idem, p. 95, 1906.

Pagodia monkei WALCOTT, Research in China, vol. 3, Carnegie Inst. Washington Publ. 54, p. 7, 1913.

Upper Cambrian, Changshan; Tsing-chou, Shantung, China.

Cotypes.—Freiburg Mus.

Chuangia hopeiensis, new species

Chuangia batia SUN, Geol. Surv. China, Pal. Sinica, ser. B, vol. 7, fasc. 2, p. 21, pl. 1, figs. 14-17, 1935.

Compared with *C. batia,* this species has a wide brim. Sun's specimens are evidently exfoliated and consequently have deeper furrows than appear on the outer surface. The eyes are of normal size, situated just behind the midpoint of the glabella.

Upper Cambrian, Wolungshan; Huolu, Hopei, China.

Cotypes.—Nat. Peiping Univ. Nos. S1124-S1127.

Chuangia huoluensis, new species

Chuangia nitida SUN, Geol. Surv. China, Pal. Sinica, ser. B, vol. 7, fasc. 2, p. 25, pl. 1, figs. 8, 9, 1935.

The cranidium is short, with prominent palpebral lobes, and has a straight front margin. The pygidium is more transverse than either *C. batia* or *C. hopeiensis.* It also has a less circular outline, hence the pleural lobes narrow toward the anterior angles.

Upper Cambrian, Wolungshan; Huolu, Hopei, China.

Cotypes.—Nat. Peiping Univ. Nos. S1118, S1119.

CLAVASPIDELLA Poulsen, 1927

Clavaspidella tolli, new species

Bathyuriscus howelli VON TOLL, Mem. Acad. Imp. Sci. St. Petersburg, ser. 8, vol. 8, No. 10, p. 30, pl. 2, fig. 11, 1899.

Toll recognized the true affinity of this pygidium but failed to see that it was different from *C. howelli.* Compared with that species, *C. tolli* has a wider pygidium, a slightly shorter and more slender axis. This species is characterized by its slender tapering axis and rather shallow pleural furrows.

Middle Cambrian, below Arürach, right bank Olenek River, Siberia.

Holotype.—Acad. Sci. Leningrad.

Clavaspidella piochensis, new species

Olenoides spinosus WALCOTT (part), U. S. Geol. Surv. Bull. 30, p. 184, pl. 25, fig. 6a, 1886.

The cranidium from Pioche, Nev., illustrated by Walcott, is not in the matrix of the pink Chisholm shale but occurs in a yellowish micaceous sandy shale. According to present knowledge such rock occurs only in the Comet shale, and we may tentatively assume that this specimen was derived from that formation.

The original illustrations show that this cranidium is not the same as *Zacanthoides spinosus* from the Eureka district, and a little further comparison shows that it is a species of *Clavaspidella* and not of *Zacanthoides*. Naturally after this discovery one turns to *C. howelli,* also from near Pioche, to test specific identity. While Walcott's figures of *C. howelli* appear quite different from *C. piochensis,* the real distinction has been accentuated by poor drawing. Nevertheless, *C. piochensis* is specifically distinct from *C. howelli.*

C. piochensis is characterized by a large glabella which expands considerably in the anterior half. Four pairs of glabellar furrows are clearly shown. The brim consists of a simple upturned rim. Fixigenes confined to the palpebral lobes and small triangular areas at the anterior angles. Anterior facial suture diverges considerably. A remarkable feature is the extraordinary length of the posterolateral limbs. Surface features are not preserved, except that the occipital ring seems to be wrinkled.

Middle Cambrian, Comet?; Pioche, Nevada.

Holotype.—U.S.N.M. No. 102316.

CONASPIS Hall, 1863

Conaspis whitehallensis (Walcott)

Conocephalina whitehallensis WALCOTT, Smithsonian Misc. Coll., vol. 57, No. 9, p. 269, pl. 44, figs. 9-11a, 1912.

This species was evidently referred to *Conokephalina* on the basis of the illustration. The type cranidium was not completely freed from the matrix, and in some manner the lighting in the photograph accentuated the convexity of the fixigenes and preglabellar area so that it resembled the cranidium on which *Conokephalina* is founded. Careful comparison with the type of *Conaspis, C. perseus,* shows that this species is more properly referred to that genus, although doubt still remains concerning the trilobite to which *C. perseus* properly applies.

Upper Cambrian, Theresa; (loc. 110a) Whitehall, Washington County, New York.

Holotype.—U.S.N.M. No. 58579; paratypes, Nos. 58580, 58581.

COOSIA Walcott, 1911

Coosia alethes (Walcott)

Blountia alethes Walcott (part), Smithsonian Misc. Coll., vol. 64, No. 5, p. 307, pl. 64, figs. 1, 1a, 1916 (not figs. 1b, 1c = *Maryvillia arion*).

Coosia alethes Resser (part), Geol. Soc. Amer. Spec. Pap. 15, p. 71, 1938.

It is necessary to restrict this species to the cranidium. Pygidia are present in the collection but were not illustrated. Those formerly assigned to the species belong to *Maryvillia,* as that genus is now construed.

Upper Cambrian, Nolichucky; (loc. 123b) ½ mile east of Rogersville, Tennessee.

Holotype.—U.S.N.M. No. 62821.

CREPICEPHALINA Resser and Endo, 1935

Crepicephalina Resser and Endo, *in* Kobayashi, Journ. Fac. Sci. Imp. Univ. Tokyo, sect. 2, vol. 4, pt. 2, p. 277, 1935; Manchurian Sci. Mus. Bull. 1, pt. 2, p. 195, 1937.

Mesocrepicephalus Kobayashi, Journ. Fac. Sci. Imp. Univ. Tokyo, sect. 2, vol. 4, pt. 2, p. 277, 1935.

When Kobayashi established *Mesocrepicephalus* and at the same time recognized the validity of *Crepicephalina* Resser and Endo, he based his study entirely on Walcott's figures of *C. convexa* and *C. damia,* without observing that both are incorrectly drawn. A study of the types shows that both are generically identical, even though the cranidium of *C. damia* appears somewhat different, owing to the very great concavity of the brim and the steepness of the slope from the glabella into it. A difference is also found in the pygidium, for the spines are heavier in some species than in others, but in the supposedly related *Tricrepicephalus,* variation in this respect goes to great extremes, hence this fact need not be given generic importance in this case.

Genotype.—Crepicephalus convexus Walcott.

Crepicephalina damia (Walcott)

Crepicephalus damia Walcott, Proc. U. S. Nat. Mus. vol. 29, p. 92, 1905; (part), Research in China, vol. 3, Carnegie Inst. Washington Publ. 54, p. 141, pl. 13, figs. 14, 14b, 1913.

Menocephalus acerius Walcott (part), idem, p. 174, pl. 16, fig. 10a, 1913.

Mesocrepicephalus damia Kobayashi, Journ. Fac. Sci. Imp. Univ. Tokyo, sect. 2, vol. 4, pt. 2, p. 277, 1935.

Middle Cambrian, Changhia; (loc. C18) 1 mile east of Changhia, Shantung, China.

Holotype.—U.S.N.M. No. 57986; paratypes, Nos. 57988, 58090.

Crepicephalina kaipingensis (Sun)

Conokephalina kaipingensis SUN, Geol. Surv. China, Pal. Sinica, ser. B, vol. 1, fasc. 4, p. 47, pl. 3, figs. 4 a-b, 1924.

Crepicephalus sp. SUN, idem, p. 49, pl. 3, fig. 6, 1924.

Lower Cambrian, Manto; Chengshan, Chaokouchuang, Kaiping basin, Chihli, China.

Cotypes.—Geol. Surv. China Nos. 550, 551, 555.

DICTYELLA Kobayashi, 1933

Dictyella manchurica (Kobayashi)

Hysterolenus (?) manchuricus KOBAYASHI, Jap. Journ. Geol. and Geogr., vol. 11, Nos. 1, 2, p. 150, pl. 15, fig. 6, 1933; ENDO, Manchurian Sci. Mus. Bull. 1, pt. 3, p. 342, pl. 71, fig. 4, 1937.

Upper Cambrian, Yenchou; Paichiashan, near Chinchiachengtzu, Manchoukuo.

Holotype.—Geol. Inst. Univ. Tokyo (cast, U.S.N.M. No. 94062); plesiotypes, Manchoukuo Sci. Mus. No. 1319.

DORYPYGE Dames, 1883

Dorypyge DAMES, von Richthofen's China, vol. 4, p. 23, Berlin, 1883.

Like most other Cambrian genera of long standing, *Dorypyge* needs revision. Species of *Kootenia* and *Olenoides* from North America and Siberia were referred to it and subsequently removed. Atlantic Province species are also assigned to *Dorypyge,* and the problem created by those references is discussed on a subsequent page. Here are listed the valid Asiatic species now in *Dorypyge.* Cross references to forms based on described material are included.

D. bigranosa Resser and Endo
D. bispinosa Walcott
D. damesi Resser and Endo
D. kidoi Resser and Endo
D. lei Resser and Endo
D. manchuriensis Resser and Endo
D. matsushitai Resser and Endo
D. perconvexa Resser and Endo
D. pergranosa Resser and Endo
D. richthofeni Dames
D. richthofeni Walcott = { *D. suni*, *D. manchuriensis*, *D. damesi*
D. richthofeni Lorenz = *D. lorenzi*
D. richthofeni laevis Walcott = *D. laevis*
D. semicircularis Resser and Endo
D. taitzuensis Resser and Endo
D. toyami Resser and Endo

Dorypyge richthofeni Dames

Dorypyge richthofeni DAMES, *in* von Richthofen's China, vol. 4, p. 24, pl. 1, figs. 1-6, Berlin, 1883; KOBAYASHI, Journ. Geol. Soc. Japan, vol. 44, No. 524, p. 434, pl. 17, figs. 13a, 13b, 1937.

The following is a free translation of the essential portions of Dames' excellent description. It is reprinted because the original is hard to get.

The glabella is highly arched, bounded by practically parallel longitudinal furrows, which deepen into pits near the frontal rim; anteriorly bluntly rounded off. The glabella reaches to the anterior edge; in front of it there is only a narrow obliquely upturned frontal rim. Three pairs of horizontal glabellar furrows are sharply impressed on the moulds, and also appear on the shell surface. On the former all pairs make very shallow furrows, but on the shell surface one can scarcely see the furrows, except that they have been made clearer because in them the granulations which cover the rest of the surface are wanting, and hence they appear as narrow smooth strips. The fixed cheeks are arched evenly, although clearly less than the glabella; the eye lobes are situated at about the middle and extend from about the last to the first pair of glabellar furrows. The facial sutures run forward from them to the anterior margin, converging a little, and behind the eyes they diverge very rapidly to the posterior margin. The neck ring is small and sharply defined on the fixed cheeks, and behind the glabella is swollen, and from it a raised spine is directed obliquely backward. This spine is hollow and appears to have had considerable length.

The surface of the cranidium is covered with small papillae which are distributed in such a manner that they are smaller, more numerous and more crowded in the anterior than in the posterior portions, and further, that they are larger and farther apart on the cheeks than on the glabella. The dorsal, glabellar and occipital furrows lack the papillae.

The pygidium of the largest individual is about 15 mm. long and 24 mm. wide at the front and is of a rounded triangular shape. The rhachis of this specimen is about 8 mm. wide at the top, highly arched, sharply defined both on the sides and behind. At the rear it drops off almost perpendicularly and does not quite reach the posterior margin, leaving a space something like 2 mm. wide. It is divided by deep furrows into four segments. In well-preserved specimens, close to its rounded-off end, one can observe one or two more rather shallow furrows as indications of a very poor further segmentation. The surface is covered with papillae, which, however, occur in the furrows between the segments only along the median line, and on the whole, become somewhat fewer and smaller toward the rear. The lateral portions are much less arched than the rhachis, and drop off to an almost horizontal border. They are divided into four segments by deep and wide furrows, which stop at the sharply defined horizontal border. The relative position of the axial and pleural furrows is rather strange. They alternate, that is the pleural furrows meet the axial rings and oppositely, the axial furrows meet the pleural segments. The segments have a shallow furrow on their surface which is delimited by two ridges. It is only on these ridges that individual papillae occur, the segment being otherwise smooth. The border of the pygidium is drawn out into rounded, pointed spines. Each of the four segments gives rise to a short spine, which is directed almost straight out in the first segment, while in the following ones, the spines are gradually turned farther

back. These four spines on each side are about of equal length. Next behind the last of these four pairs of spines, a fifth arises, which is distinguished from the others by its considerable thickness and length, and it is directed straight backward. At the posterior margin, between this fifth pair of spines, is a further pair of pointed protuberances, just about at the point where the longitudinal furrows delimiting the rhachis would reach the posterior edge, if they were projected.

Two corrections should be made in the foregoing description. First, the statement that the facial suture converges anterior to the eye is not true. Examination of Dames' types in Berlin revealed that none of the specimens were prepared completely, simply being drawn as far as they came free of the matrix when the containing rock was broken. Since the edges are turned sharply down, it is difficult to uncover completely the anterior angles, and consequently, most illustrations are incorrectly drawn at these points. If, however, the down-turned anterior angles are entirely cleaned out, the anterior facial suture is seen to diverge at the average angle for the genus.

The second slight correction to be made in Dames' description is regarding distribution of granules on the pygidial rhachis (provided, of course, that Dames was discussing the same tail as is herewith associated with the cranidium). There are two sets of granules, the larger occurring only on the upper surfaces of the axial rings, thinning out almost to extinction on the pleura, while a set of smaller granules occupies the slopes into the axial furrows, the bottoms of which are smooth. It might be mentioned further that the large fifth marginal spine is not only directed backward, but turns up from the horizontal plane considerably more than in most other species.

When Endo and I restudied the question of the *Dorypyge* species, we still had the incorrect notion that Dames' types were from Shantung. Since Dames got his specimens in Manchoukuo, it is necessary to restrict *D. richthofeni* to them, which eliminates the species from China proper. The specimens used by Lorenz, by Walcott, and by Sun all belong to unnamed species as indicated in the following pages.

Middle Cambrian, Taitzu; Wulopu, south of Hsiaoshih, Manchoukuo.

Lectotype and paratypes.—Natur. Mus. Berlin.

Dorypyge laevis Walcott

Dorypyge richthofeni laevis WALCOTT, Proc. U. S. Nat. Mus., vol. 30, p. 573, 1906; Research in China, vol. 3, Carnegie Inst. Washington Publ. 54, p. 109, pl. 8, figs. 2, 2b, 1913.

No change in the nomenclature of this species is necessary except to recognize it as a full species, but a brief discussion is desirable.

As stated in the original description the surface lacks pustules and therefore stands alone among described Chinese forms. However, examination in proper light reveals irregularity beneath, rather than on, the surface. Besides its smoothness this species is not so highly arched in either direction as *D. richthofeni,* neither are the anterior angles of the fixigenes turned down so sharply. The eyes appear to be a little farther forward; glabellar furrows are represented by the faintest of markings and the occipital furrow, both on the fixigenes and glabella, is very much less impressed. *D. laevis* has a longer and stouter, erect neck spine. An associated smooth libragene is regarded as representing the species.

Fragments of a smooth pygidium are found at another locality with the illustrated hypostoma and a head which appears to agree with the holotype. Besides being smooth, the pygidium is characterized by its general flatness, although the axis remains well above the pleural lobes, and is well defined by the dorsal furrow. Both the axial and pleural furrows are shallower than usual. Slight traces of pleural grooves are visible.

Middle Cambrian, Changhia; (loc. C72) east of Fang-lan-chön, and (loc. C71) southwest of Tungyü, Shansi, China.

Holotype, paratypes, and plesiotypes.—U.S.N.M. Nos. 57883-57885.

Dorypyge lorenzi, new species

Olenoides (*Dorypyge*) *richthofeni* Lorenz, Deutsch. Geol. Ges. Zeitschr., vol. 58, No. 2, p. 67, pl. 4, figs. 1-5, 1906.

The specimens Lorenz assigned to *D. richthofeni* represent a distinct species. A cast of the pygidium illustrated as figure 3 is in the United States National Museum collections. Whether or not figure 4 is the same species cannot be told from Lorenz' figures, except that it seems to represent a more granulose form.

As illustrated by Lorenz the cranidium is normal in size and proportions. The glabella is somewhat protuberant and has faint furrows. The granules are evidently scattered, and the neck ring no doubt had a sizable spine. Fixigenes are shown to be of normal size and shape. The cast of the pygidium in the United States National Museum shows four slender marginal spines and a fifth long and heavy spine. The rear pair are obscured by matrix. Granulation is restricted to a few rows on the ridges of the axis and pleura.

Middle Cambrian, Changhia; Laiwu, Shantung, China.

Holotype and paratypes.—Geol. Inst. Freiburg im Br.

Dorypyge suni, new species

Dorypyge richthofeni WALCOTT (part), Research in China, vol. 3, Carnegie Inst. Washington Publ. 54, p. 108, pl. 8, figs. 1, 1c, 1913 (not 1a-d, f = *D. shantungensis*).

Of the forms formerly assigned to *D. richthofeni* by Walcott several are easily distinguished. To one of these the name *D. suni* is given in recognition of the work by Dr. Y. C. Sun on the Cambrian of China.

D. suni has faint glabellar furrows. The granules on the glabella are about the same as on the corresponding parts of *D. richthofeni*, but are underlain by an irregular and poorly developed system of fine anastomosing lines, and differ further in that they maintain approximately the same size and density on both the glabella and fixigenes. Furthermore, in cross section the convexity of the glabella, but not of the fixigenes, is greater.

The pygidium assigned to the species has only a few granules on the axis. The pleural lobes are marked by rather strong wirelike lines on the edges where the slope into the furrow begins.

Middle Cambrian, Changhia; (loc. C1) 2 miles south of Yenchuang, and (loc. C57) 3 miles south of Kaokiapu, Shantung, China.

Holotype and paratypes.—U.S.N.M. Nos. 57876, 57877.

Dorypyge shantungensis, new species

Dorypyge richthofeni WALCOTT (part), Research in China, vol. 3, Carnegie Inst. Washington Publ. 54, p. 108, pl. 8, figs. 1a, 1c, 1d, 1f, 1913 (not 1, 1b, 1e = *D. suni*).

The remaining specimens referred by Walcott to Dames' species, after removal of *D. suni,* constitute another well-defined species. Size and shape are similar to *D. suni,* but the surface is more strongly granulated by rather evenly distributed granules of nearly even size. The macrospinal development involves the fourth pygidial spine, back of which is only a pair of nodes. Figure 1b of Walcott is doubtful.

Middle Cambrian, Changhia; (locs. C19, 29) Changhia south of Tsi-nan-fu, and (loc. C1) Yenchuang, Sintai district, Shantung, China.

Holotype.—U.S.N.M. No. 57878; paratypes, Nos. 57877, 57879, 57881.

Dorypyge chihliensis, new species

Dorypyge richthofeni SUN, Geol. Surv. China, Pal. Sinica, ser. B, vol. 1, fasc. 4, p. 29, pl. 2, figs. 3a-d, 1924.

Among the specimens Sun referred to *D. richthofeni,* one species is clearly indicated by Sun's illustration, and it is possible that figure 3a represents another.

Compared with *D. richthofeni* the Chihli species has a wider glabella, fewer granules, and possibly wider fixigenes. The glabella is less protuberant and the rim wider. In the pygidium the ribs, spines, and axis are all more robust, and the spines are curved backward to a greater degree. Sun's specimens are only partly exfoliated, hence it is clear that *D. chihliensis* has deep and wide pygidial furrows. The first four pairs of spines increase in size and length rearward, and the fifth is rather stout and must have been as long as the pygidium.

Middle Cambrian, Changhia; Chengshan, Chaokouchuang, Chihli, China.

Holotype.—Geol. Surv. China No. 519; paratypes, Nos. 517, 520.

Further revision of the Asiatic species is necessary, but the foregoing will suffice for present purposes. We need only add that the Geological Survey of China has on hand a number of undescribed forms, so that the genus is represented by many species.

Dorypyge slatkowskii (Schmidt) from Siberia is a typical *Kootenia*. (See page 27.)

ATLANTIC PROVINCE SPECIES REFERRED TO DORYPYGE

Two species referred to *Dorypyge* are described from Denmark, four from England, and four from New Brunswick, all of which are in the Baltic division of the Atlantic Province. The list shows present reference.

Denmark
- *D. danica* Grönwall
- *D. oriens* Grönwall

England
- *D. lakei* Cobbold = *Kootenia lakei*
- *D. reticulata* Cobbold = *Kootenia reticulata*
- *D.* cf. *richthofeni* Nicholas = *Dorypyge* sp.
- *D. rushtonensis* Cobbold and Pocock

New Brunswick
- *D. horrida* Matthew = *Olenoides horridus*
- *D. quadriceps valida* Matthew = *Kootenia valida*
- *D. wasatchensis acadica* Matthew = *Olenoides acadicus*

D. cf. *richthofeni* Nicholas consists of fragments too imperfect for generic identification. Further, these fragments are not like the other species from England, seemingly being more like *Dorypyge* proper, and hence may stand as *Dorypyge* sp.

Matthews' species from New Brunswick, all based on pygidia, appear to fit into *Olenoides* and *Kootenia,* even though they constitute an element sharply at variance with the rest of the fauna. However, they are evidently related to the British forms also referred to *Kootenia.*

On the other hand the Bornholm species are nearer *Dorypyge* proper than they are to most of the British and New Brunswick species. It is interesting to note that two undescribed species occur together in the Manuels formation, southeastern Newfoundland. One is very close to, or perhaps identical with *D. danica* Grönwall. The other differs by having the first large marginal spine set much farther forward. Thus it is apparent the large spines shift position, and that different spines receive the macropleural development in different species just as happens in *Dorypyge*. The Bornholm and Newfoundland species are retained in *Dorypyge,* although they likely represent another genus. With them is placed *D. rushtonensis* Cobbold and Pocock from the Rushton area, Shropshire.

EMMRICHELLA Walcott, 1911

Emmrichella has full generic rank. Consequently the several species placed under *Ptychoparia* (*Emmrichella*) are to be regarded as belonging to *Emmrichella,* unless transferred to other genera because of incorrect identification.

Emmrichella nodosa (Sun)

Solenopleura nodosa Sun, Geol. Surv. China, Pal. Sinica, ser. B, vol. 1, fasc. 4, p. 56, pl. 4, figs. 3a, b, 1924.

Middle Cambrian, Nanchuang; Chaokouchuang, Luanhsien, Chihli, China.

Holotype and paratype.—Geol. Surv. China Nos. 577, 578.

EOAGNOSTUS Resser and Howell, 1938

Eoagnostus Resser and Howell, Bull. Geol. Soc. Amer., vol. 49, No. 2, p. 216, 1938; Kobayashi, Journ. Fac. Sci. Imp. Univ. Tokyo, sect. 2, vol. 5, pt. 5, p. 122, 1939.

Archaeagnostus Kobayashi, idem.

Kobayashi copied the description of *Archaeagnostus* from a manuscript in my office but meanwhile we had decided to use a shorter name, and so published it.

Mallagnostus desideratus, also from the Schodack formation of the Hudson Valley, appears to represent a valid genus, thus constituting a second Lower Cambrian agnostid genus.

Eoagnostus primigeneus (Kobayashi)

Agnostus sp. Walcott, U. S. Geol. Surv. 10th Ann. Rep., p. 630, pl. 80, figs. 6, 6a, 1891.

Archaeagnostus primigenius KOBAYASHI, Journ. Fac. Sci. Imp. Univ. Tokyo, sect. 2, vol. 5, pt. 5, p. 112, 1939.

Schodack: (loc. 43a) 1 mile northeast of Salem; and (loc. 38a) 2 miles south of North Granville, New York.

Cotypes.—U.S.N.M. No. 18328.

ETERASPIS Resser, 1935

It has been only in recent months that the existence of *Eteraspis* beyond Nevada was recognized. This genus has become a good guide fossil for the later Middle Cambrian formations. Besides the Eureka district it is now known from the Bloomington formation in the Wasatch Mountains, from the Maryville of the Appalachians, and possibly from the Eldon of the Canadian Rockies.

Eteraspis glabra (Walcott)

Asaphiscus (Blainia) glabra WALCOTT, Smithsonian Misc. Coll., vol. 64, No. 5, p. 394, pl. 63, figs. 1-1e, 1916.

Blountia glabra RESSER, ibid., vol. 95, No. 22, p. 3, 1937; Geol. Soc. Amer. Spec. Pap. 15, p. 64, pl. 12, figs. 31, 32, 1938.

Middle Cambrian, Maryville; (loc. 107x) Copper Ridge, 2 miles south of Heiskell, Tennessee.

Cotypes.—U.S.N.M. Nos. 62804-62808.

Eteraspis paula (Walcott)

Asaphiscus (Blainia) paula WALCOTT, Smithsonian Misc. Coll., vol. 64, No. 5, p. 395, pl. 62, figs. 2-2b, 1916.

Blania ? paula RESSER, Geol. Soc. Amer. Spec. Pap. 15, p. 62, pl. 9, fig. 3, 1938.

Middle Cambrian, Maryville: (loc. 90x) near Blaine, 3 miles south of Center, Alabama.

Lectotype.—U.S.N.M. No. 62802; paratype, No. 62803.

Eteraspis crassa (Resser)

Blountia crassa RESSER, Geol. Soc. Amer. Spec. Pap. 15, p. 64, pl. 12, fig. 23, 1938.

Middle Cambrian, Maryville; (loc. 107u) Copper Ridge, 2 miles south of Heiskell, Tennessee.

Holotype.—U.S.N.M. No. 94943.

EUPTYCHASPIS ULRICH, 1930

Euptychaspis minuta (Whitfield)

Ptychaspis minuta WHITFIELD, Ann. Rep. Wisconsin Geol. Surv. for 1877, p. 55, 1878; Geol. Wisconsin, vol. 4, p. 186, pl. 1, figs. 25, 26, 1882; CHAMBERLAIN, Geol. Wisconsin, vol. 1, p. 130, fig. 1883.

The specimens in the National Museum collections long ago identified as *Ptychaspis minuta* Whitfield agree with his illustrations and

description, consequently they may be taken as typical of the species. In the original description the horizon is not clearly indicated. With these specimens and the description of the matrix in which Whitfield's types occur, it may be concluded that this species occurs in the Norwalk sandstone member. Several well-preserved examples show that this trilobite is typical of the genus *Euptychaspis*.

Upper Cambrian, Norwalk; Roberts Store, St. Croix County, and (loc. 78) Osceola, Wisconsin.

Holotype and paratype.—Univ. California.

EYMEKOPS Resser and Endo, 1937

Eymekops maia (Walcott)

Ptychoparia (?) maia Walcott, Proc. U. S. Nat. Mus., vol. 30, p. 592, 1906.
Conokephalina maia (Walcott), Research in China, vol. 3, Carnegie Inst. Washington Publ. 54, p. 139, pl. 13, fig. 13, 1913.

Middle Cambrian, Changhia; (loc. 70) 4 miles southwest of Tungyü, Shansi, China.

Holotype.—U.S.N.M. No. 57984.

Eymekops irma (Walcott)

Anomocarella irma Walcott, Proc. U. S. Nat. Mus., vol. 30, p. 584, 1906; Research in China, vol. 3, Carnegie Inst. Washington Publ. 54, p. 202, pl. 19, figs. 8, 8a, 1913.

Middle Cambrian, Changhia; (loc. C77) 4 miles southeast of Yauto, Wutai, Shansi, China.

Holotype.—U.S.N.M. No. 58173; paratype, No. 58174.

HANIWA Kobayashi, 1937

Haniwa suni (Kobayashi)

Ptychaspis suni Kobayashi, Jap. Journ. Geol. and Geogr., vol. 8, No. 3, p. 181, pl. 22, figs. 7, 8a, 1931.

Upper Cambrian, Chiushukou; Hua-lien-chai, Niuhsintai basin, Manchoukuo.

Cotypes.—Geol. Inst. Univ. Tokyo.

IDIOMESUS Raymond, 1924

Idiomesus disparilis (Hall)

Agnostus disparilis Hall, 16th Ann. Rep. New York State Cab. Nat. Hist., p. 179, pl. 10, figs. 25-27, 1863; Trans. Albany Inst., vol. 5, p. 171, pl. 5, figs. 25-27, 1867; Vogdes, Amer. Geol., vol. 9, p. 394, pl. 10, fig. 15, 1892.

It has long been known that this obscure trilobite is not an agnostid, but thus far no one ventured to place it into a more proper position,

mainly because of the poor drawings published by Hall, and the fact that the matrix in which the specimens are preserved is rather coarse sand for the preservation of so small an object.

There may be some question raised respecting the validity of this reference to *Idiomesus*. Raymond's figure of the genotype does not show an occipital spine, and indicates that the glabella is delimited in front. The spine is so slender that it may have been overlooked, particularly since a node on the occipital ring is mentioned. It is my belief that the presence or absence of an occipital spine is only of specific value in most instances. In the second place, Raymond states that the glabella is not delimited in front in spite of the fact that his figure shows such a feature. So we may assume that *I. disparilis* may fall within reasonable limits of the genus *Idiomesus*. Until much more material is described it will do no harm to place this small trilobite in this genus. Several species and rather good material is available from Wisconsin. Outside of Wisconsin other species will add much to the understanding of the genus.

Upper Cambrian, Norwalk; (loc. 78) Osceola, Polk County, Wisconsin.

Cotypes.—Amer. Mus. Nat. Hist.

INOUYOPS, new genus

Characteristics of a species referred by Walcott to *Inouyia,* although somewhat like it in general appearance, warrant the erection of another genus. A second species is referred to the new genus even though it is not fully typical.

Inouyops is characterized by a long, slightly tapering glabella, on which three sets of furrows are faintly impressed. In cross section the glabella is not greatly convex, rising to a faint keel. A conspicuous feature is the greatly expanded neck ring which extends into an erect spine. The fixigenes average somewhat more than half the glabellar width, with the posterolateral limbs considerably depressed, which leaves the sharply curved eye lobes in a prominent position. The brim is wider than the fixigenes. It consists of a slightly upturned rim occupying about one-third the brim width, and a strongly convex vertically striated preglabellar area. The latter rises above the level of the anterior portion of the glabella and thus gives the genus its main aspect. Other parts unknown.

There is a considerable resemblance to *Lorenzella* Kobayashi, particularly because of the large neck ring and nuchal spine possessed by

both. *Lorenzella* is merely a narrow *Inouyia,* and is also narrower than *Inouyops,* lacking the real differentiation of preglabellar area and rim.

Genotype.—*Ptychoparia titiana* Walcott.

Inouyops titiana (Walcott)

Ptychoparia titiana Walcott, Proc. U. S. Nat. Mus., vol. 29, p. 81, 1905.
Inouyia titiana Walcott, Research in China, vol. 3, Carnegie Inst. Washington Publ. 54, p. 155, pl. 14, fig. 9, 1913.

Middle Cambrian, Changhia; (loc. C7) 2 miles southwest of Yenchuang, Shantung, China.

Holotype.—U.S.N.M. No. 58015.

Inouyops inflata (Walcott)

Ptychoparia inflata Walcott, Proc. U. S. Nat. Mus., vol. 30, p. 587, 1906.
Inouyia ? inflata Walcott, Research in China, vol. 3, Carnegie Inst. Washington Publ. 54, p. 152, pl. 14, fig. 10, 1913.
Lorenzella inflata Kobayashi, Journ. Fac. Sci. Imp. Univ. Tokyo, sect. 2, vol. 4, pt. 2, p. 254, 1935.

This species is placed in *Inouyops* although it differs from *I. titiana* in an important respect. Glabella, neck ring, and fixigenes agree closely. On the other hand, the brim is simple, consisting only of a strongly convex band without a rim. However, at the anterior angles faint traces of an anterior furrow may be seen, and so it is thought that the departure is merely due to obsolescence.

Middle Cambrian, Changhia; (loc. C69) 4 miles east of Fang-lan-chön, Shansi, China.

Holotype.—U.S.N.M. No. 58016.

KAOLISHANIA Sun, 1924

Kaolishania hopeiensis, new species

Kaolishania pustulosa Sun, Geol. Surv. China, Pal. Sinica, ser. B, vol. 7, fasc. 2, p. 59, pl. 2, figs. 25-29, 1935.

Sun's figures leave much to be desired, but it is apparent that *K. hopeiensis* is characterized by a short cranidium and a narrow pygidium. The cranidium has a straight anterior outline, and the glabella is marked by the usual furrows. The pygidial axis is long, rather strongly tapered, and the rear margin is strongly curved, with the large spines set farther forward than in *K. pustulosa.*

Upper Cambrian, Wolungshan, Huolu, Hopei, China.

Cotypes.—Tsing Hua Univ. Nos. S1161, S1164; Nat. Peiping Univ. No. S1165.

KINGSTONIA Walcott, 1924

Kingstonia thea (Walcott)

Agraulos ? thea Walcott, Proc. U. S. Nat. Mus., vol. 13, p. 277, pl. 21, fig. 15, 1890.

Pagodia thea Walcott, Smithsonian Misc. Coll., vol. 57, No. 13, p. 358, 1914; ibid., vol. 64, No. 3, pl. 37, 1916.

Komaspidella thea Kobayashi, Jap. Journ. Geol. and Geogr., vol. 15, Nos. 3, 4, p. 175, 1938.

In spite of its great abundance at many localities this species has never been adequately illustrated, and, strangely enough, apparently was not contained in the collections available to Hall in 1863. Walcott figured the cranidium in 1890, but disregarded several pygidia that lie within an inch of it, and again in 1916 designated only cranidia on the very fossiliferous slab then illustrated. In 1914 Walcott merely changed the generic assignment in faunal lists. Recently Kobayashi gave this species a new generic assignment which was unnecessary as will be explained below.

Kingstonia has been studied in recent months during description of many new species. Hitherto observers failed to note that the Wisconsin specimens are internal casts and consequently that they do not have the true aspect of their respective genera, for this mode of preservation always exaggerates the furrows. In fact, in *K. thea* it is likely that the test of both shields would show only a trace of the dorsal furrows. Among the many species now being described from North America, examples of complete shields occur together with partially or completely exfoliated examples. This condition of preservation is found not only in *Kingstonia* but also in *Bynumia* and other closely allied genera. From studies it is clear that *Agraulos? thea* is a *Kingstonia*.

Some doubt exists respecting the type locality. In 1890 Walcott gave it as Osceola Mills, but the specimens are labeled as coming from Eau Claire. It may be assumed that the latter is the type locality.

Upper Cambrian, Eau Claire; (loc. 78a) Eau Claire, and many other localities in Wisconsin.

Holotype.—U.S.N.M. No. 23864; plesiotypes on No. 61737.

Kingstonia seelyi (Walcott)

Pagodia seelyi Walcott, Smithsonian Misc. Coll., vol. 57, No. 9, p. 269, pl. 44, figs. 12-14a, 1912.

Lloydia seelyi Raymond (part), Proc. Boston Soc. Nat. Hist., vol. 37, No. 4, p. 410, 1924.

Upper Cambrian, Potsdam; (locs. 136, 136a) near Port Henry, Essex County, New York.

Cotypes.—U.S.N.M. Nos. 58582-58584.

KOOTENIA Walcott, 1888

Kootenia burgessensis, new species

Kootenia dawsoni WALCOTT, Smithsonian Misc. Coll., vol. 67, No. 4, p. 131, pl. 14, figs. 2, 3; 1918.

Ncolenus serratus WALCOTT (part), idem, p. 126, pl. 36, fig. 3, 1918.

This species was identified with *K. dawsoni,* but differs considerably from that species. *K. burgessensis* has a quadrangular glabella, only slightly rounded in front. Fixigenes are slightly less than half the width of the glabella, and the libragenes have genal spines which reach back to about the third segment. In the pygidium the distinctive characteristic of the species is found in the six wide, rapidly tapering marginal spines. They separate the species from *K. dawsoni,* which has longer, much narrower spines.

Middle Cambrian, Burgess shale; (loc. 35k) Burgess Pass, near Field, British Columbia.

Holotype.—U.S.N.M. No. 65511; paratypes, Nos. 65512, 65533.

Kootenia slatkowskii (Schmidt)

Proctus (Phacton) slatkowskii SCHMIDT, Bull. Acad. Imp. Sci. St. Petersburg, vol. 30, p. 418, figs. 11-14, 1886.

Dorypyge slatkowskii VON TOLL, Mem. Acad. Imp. Sci. St. Petersburg, scr. 8, vol. 8, No. 10, p. 33, pl. 2, figs. 1-10, 1899; LERMONTOVA, Bull. Com. Geol. Leningrad, vol. 43, No. 9, p. 1105, pl. 17, figs. 1-12, 1926.

Middle Cambrian, Torgoshino limestone; Jenissei River, Siberia.

Cotypes and plesiotypes.—Leningrad.

Kootenia reticulata (Cobbold)

Dorypyge reticulata COBBOLD, Quart. Journ. Geol. Soc. London, vol. 69, p. 33, pl. 3, figs. 1-15, 1913; LAKE, Mon. British Cambr. Tril. Pal. Soc., pt. 11, p. 257, pl. 37, figs. 1-12, 1938.

Middle Cambrian, breccia bed of Upper Comley sandstone, Comley, Shropshire, England.

Holotypes and paratypes.—Sedgwick Mus. Cambridge Nos. A4446, A180-189.

Kootenia lakei (Cobbold)

Dorypyge lakei COBBOLD, Quart. Journ. Geol. Soc. London, vol. 67, p. 287, pl. 25, figs. 1-8, text fig., 1911; ibid., vol. 87, p. 470, pl. 40, fig. 3, 1931; COBBOLD and POCOCK, Phil. Trans. Roy. Soc. London, ser. B, vol. 223, p. 373, 1934; LAKE, Mon. British Cambr. Tril. Pal. Soc., pt. 11, p. 255, pl. 36, figs. 2-12, 1938.

Middle Cambrian, *Paradoxides groomi* grits; Comley and Rushton, Shropshire, England.

Holotype and paratypes.—Sedgwick Mus. Cambridge Nos. A66-70.

Kootenia valida (Matthew)

Dorypyge quadriceps valida MATTHEW, Trans. Roy. Soc. Canada, ser. 2, vol. 3, sect. 4, p. 189, pl. 4, figs. 2c, d, 1897.

Middle Cambrian, St. John 1d3; Hastings Cove, New Brunswick.

Holotype.—Roy. Ontario Mus. No. 8413.

LIOPARIA Lorenz, 1906

Lioparia burea (Walcott)

Ptychoparia (Proampyx) burea WALCOTT, Proc. U. S. Nat. Mus., vol. 29, p. 86, 1905.

Proampyx burea WALCOTT, Research in China, vol. 3, Carnegie Inst. Washington Publ. 54, p. 145, pl. 14, fig. 3, 1913.

When the holotype of *Proampyx burea* is carefully examined, it clearly falls within this genus. In the illustrated holotype the elevated central portion of the brim was carried away by the matrix.

Upper Cambrian, Tawenkou (*Chuangia* zone); (loc. C61) southwest of Yenchuang, Shantung, China.

Holotype.—U.S.N.M. No. 58001.

LISANIA Walcott, 1911

Lisania (?) tellus (Walcott)

Ptychoparia tellus WALCOTT, Proc. U. S. Nat. Mus., vol. 29, p. 80, 1905.

Lonchocephalus tellus WALCOTT, Research in China, vol. 3, Carnegie Inst. Washington Publ. 54, p. 143, pl. 14, fig. 1, 1913.

Middle Cambrian, Changhia; (loc. C2) 2 miles south of Yenchuang, Shantung, China.

Holotype.—U.S.N.M. No. 57997.

MANCHURIELLA Resser and Endo, 1931

Manchuriella yohi (Sun)

Ptychoparia yohi SUN, Geol. Surv. China, Pal. Sinica, ser. B, vol. 1, fasc. 4, p. 42, pl. 2, fig. 12, 1924.

Lower Cambrian, Manto; Chengshan, Chaokouchuang, Hopei, China.

Holotype.—Geol. Surv. China No. 535.

Manchuriella? leichuangensis (Sun)

Ptychoparia leichuangensis SUN, Geol. Surv. China, Pal. Sinica, ser. B, vol. 1, fasc. 4, p. 41, pl. 2, figs. 11a, b, 1924.

Lower Cambrian, Manto; Leichuang, Luanchou, Chihli, China.

Cotypes.—Geol. Surv. China Nos. 533, 534.

Manchuriella impar (Walcott)

Ptychoparia impar WALCOTT, Proc. U. S. Nat. Mus., vol. 29, p. 78, 1905; Research in China, vol. 3, Carnegie Inst. Washington Publ. 54, p. 131, pl. 12, figs. 9, 9a, 1913.

Lower Cambrian, Manto; (loc. C17) Changhia, Shantung, China.

Holotype and paratype.—U.S.N.M. Nos. 57950, 57951.

Manchuriella yenchouensis, new name

Ptychoparia impar var. WALCOTT, Proc. U. S. Nat. Mus., vol. 29, p. 79, 1905; Research in China, vol. 3, Carnegie Inst. Washington Publ. 54, p. 132, pl. 12, fig. 10, 1913.

Middle Cambrian, Changhia; (loc. C8), Yenchuang, Shantung, China.

Holotype.—U.S.N.M. No. 57952.

Manchuriella shantungensis, new species

Anomocare minus WALCOTT (part), Research in China, vol. 3, Carnegie Inst. Washington Publ. 54, p. 192, pl. 19, fig. 1, 1913 (not figs. 1a, 1b = genotype; *M. typa,* figs. 1c, 1d = *Prosaphiscus yabei*).

Manchuriella mina RESSER and ENDO, Manchurian Sci. Mus. Bull. 1, pt. 2, p. 242, pl. 36, fig. 2, 1937.

This species is typical of *Manchuriella,* but has a rather wide brim. Glabellar furrows very faint. Eyes situated about midpoint of glabella.

Middle Cambrian, Changhia; (loc. C9) 3 miles southwest of Yenchuang, Shantung, China.

Holotype.—U.S.N.M. No. 58156.

Manchuriella gerardi (Sun)

Conokephalina gerardi SUN, Geol. Surv. China, Pal. Sinica, ser. B, vol. 1, fasc. 4, p. 48, pl. 3, figs. 5a-c, 1924.

Lower Cambrian, Manto; Chengshan, Kaiping basin, Hopei, China.

Cotypes.—Geol. Surv. China Nos. 552-554.

MANSUYIA Sun, 1924

Mansuyia SUN, Geol. Surv. China, Pal. Sinica, ser. B, vol. 1, fasc. 4, p. 50, 1924; ibid., vol. 7, fasc. 2, p. 57, 1935; KOBAYASHI, Journ. Fac. Sci. Imp. Univ. Tokyo, sect. 2, vol. 4, pt. 2, p. 302, 1935; Journ. Geol. Soc. Japan, vol. 45, No. 534, p. 323, 1938.

This genus has a somewhat uncertain status because of the indefinite meaning of the genotype. Kobayashi (1938) recently called attention to the problem without offering a solution. All discussions of *Mansuyia* state that the genus is based on *M. orientalis.* Therefore, if the species *orientalis* is precisely determined, the genus will likewise

gain a precise legal status. Our problem then becomes the determination of the specimens on which *M. orientalis* is rightfully based, and these will in turn give the characterization of the genus *Mansuyia*.

In 1924 Sun described *Mansuyia* by comparing the cranidium with *Crepicephalus* and the pygidium with *Anomocare, Anomocarella,* and *Ceratopyge*. He further stated that

> this genus is characterized by its short oblong glabella, narrow fixed cheeks, and absence of the palpebral ridge. The pygidium has two inward-curving slender lateral spines which spring out from the second segment of the pleural lobe of the pygidium.

He designated the genotype as *Mansuyia orientalis* (Grabau) Sun.

Mansuyia orientalis is described on page 50, immediately after the generic presentation. Reading of the description raises no questions, as all seems to be clear and straightforward. On the other hand, examination of the bibliographic references, the locality and the plate descriptions, raises serious problems. Further complications arise from the fact that the seven illustrated specimens represent two genera and at least three species.

First is the question of the author of the species. In his bibliography Sun cites as the first reference: "1922 *Ceratypyge orientalis* Grabau (Mss)." This evidently means that in 1922 Grabau attached this name to some undescribed specimens in the collections. The next reference reads: "1923 *Ceratopyge orientalis* Sun. Upper Cambrian of Kaiping Basin. Bulletin of the Geological Society of China, vol. 2, No. 1-2, p. 98 (listed)." From this it is apparent that neither reference is a description of the species, hence *Ceratopyge orientalis* Grabau is a nomen nudem, and the first valid use of the name is *Mansuyia orientalis* Sun, 1924. In 1935 Sun ascribed the species to himself as author.

Next arises the question as to which specimens are *M. orientalis*. The locality description leads one to the assumption that the types of the species come from Shantung. This is a natural inference because the words "also found in Chihli" are used to introduce the citation of the second locality. Likewise the plate descriptions leave the same impression. However, in the plate description the first five specimens from Shantung are called "cotypes," and the remaining two (figs. 7i, j) from Chihli, "types of *Ceratopyge orientalis* Grabau." From the bibliographic citations it is evident that Sun regarded the pygidia to which Grabau attached the manuscript name as the types of the species and his "cotypes" are paratypes. This is conclusively shown to be a fact by the statement Sun made in 1935. The initial sentence

of the revised description of *Mansuyia* reads: "This genus was founded by myself based upon several pygidia of the *Ceratopyge* type and several associated cranidia which are now referred to another distinct genus *Taishania.*" Therefore, it is clear that *Mansuyia* rests on *M. orientalis* Sun, which in turn is based on two pygidia from the Fengshan limestone, Yehli, Kaiping basin, Chihli, bearing the numbers G. S. C. 563, 564.

Great confusion was introduced in the 1935 report by reference of *all* specimens of *M. orientalis* on one page to *Taishania taianensis,* and on other pages, figures 7f-h to *M. orientalis;* figures 7i, j, the types of *M. orientalis,* which is a good species from Shantung, to *M. tani.* However, none of this affects the status of the genus and its type species.

Mansuyia orientalis (Sun)

Mansuyia orientalis SUN (part), Geol. Surv. China, Pal. Sinica, ser. B, vol. 1, fasc. 4, p. 50, pl. 3, figs. 7i, 7j, 1924.

Thus far no forms conspecific with the cotypes have been illustrated, hence the species rests solely on the original types. Below will be found references of other forms erroneously referred to the species.

Upper Cambrian, Fengshan; Yehli, Kaiping basin, Chihli, China.

Cotypes.—Geol. Surv. China Nos. 563, 564.

Mansuyia endoi, new name

Mansuyia orientalis SUN (part), Geol. Surv. China, ser. B, vol. 1, fasc. 4, p. 50, pl. 3, figs. 7a-7d, 1924; ENDO, Jubilee Publ. Comm. Prof. Yabe's 60th Birthday, p. 11, pl. 2, figs. 13-20, 1939.

Upper Cambrian, Kaolishan; Kaolishan, Taian, Shantung, China.

Cotypes.—Geol. Surv. China Nos. 556-559; plesiotypes, Manchoukuo Sci. Mus.

MARYVILLIA Walcott, 1916

Maryvillia WALCOTT, Smithsonian Misc. Coll., vol. 64, No. 5, p. 400, 1916.

Ever since *Maryvillia* was described it has been necessary to exercise arbitrary selection of pygidia for almost every species, and the selection became increasingly difficult as the number of species increased. No trouble arose concerning the cranidia, but the pygidia became less and less distinguishable from *Blountia* and *Kingstonia.* Recent study of the species of the *Coosia* group led to recognition of a new genus for a series of trilobites, clearly related to *Coosia,* but which do not fit into described genera. As the work progressed the proposed genus in turn became unsatisfactory. Finally it became clear

that pygidia, congeneric with that originally assigned to *Maryvillia arion,* fall into *Blountia,* where they fit well. *Maryvillia* may then be reconstructed on the basis of cranidial structure and the associated pygidium of *Coosia* affinities assigned to it. Unfortunately this necessitates change in nomenclature of Appalachian and other described species. On the other hand, a large number of other species become clear, *Maryvillia* receiving certain species of the *Coosia* group, thereby relieving pressure at that point.

A new diagnosis of *Maryvillia* should be written to lay greater emphasis on the cranidial characters and to add those of the pygidium now assigned to the genus.

The slightly tapering glabella is large, occupying two-thirds or more of the cranidial length and over half the width. It lacks furrows, only the faintest shadows showing on exfoliated specimens. The narrow dorsal furrow is shallow, but visible in all species, and it rounds off the anterior end of the glabella. Fixigenes less than half the glabellar width; of nearly even width throughout. Anterior facial suture diverges slightly and back of the eye develops posterolateral limbs about equal in width to the fixigenes. Eyes small, situated about the midpoint of cranidium. Eye lines present on exfoliated specimens. Brim simple, concave, with a flat rim differentiated by a shallow anterior furrow produced mainly by change in slope. On exfoliated specimens the preglabellar area is apt to be more strongly convex, which serves to accentuate the anterior furrow.

Pygidium rather large, nearly semicircular in outline with a well-defined axis, usually rising high above the pleural lobes. Fusion has nearly eliminated the axial furrows, and on the test almost all of the pleural grooves and furrows, except the anterior pair. Most species have a postaxial ridge that becomes more prominent on exfoliated examples. As a whole, the pygidium is generally more strongly convex than the cranidium. From this it may be inferred that the libragenes likely had a nearly vertical position, or that they were very convex in themselves.

Genotype.—M. arion Walcott (restricted).

The cranidia of *M. arion* are all exfoliated examples. An undescribed pygidium associated with the illustrated cranidia has been selected as representative of the species, and the pygidia originally referred to *M. arion* are now regarded as belonging to *Blountia.*

M. triangularis Raymond has a doubtful status. It certainly does not belong to *Maryvillia,* and it is questionable whether it belongs to *Blountia.*

Valid species of *Maryvillia* include

Maryvillia arion Walcott (restricted)
M. ariston Walcott (restricted)
M. bristolensis Resser
M. keithi Resser
M. virginica Resser
M. widnerensis Resser

Maryvillia arion Walcott (restricted)

Maryvillia arion Walcott (part), Smithsonian Misc. Coll., vol. 64, No. 5, p. 400, pl. 64, figs. 4, 4b, 1916.
Blountia alethes Walcott (part), idem, p. 397, pl. 64, figs. 1b, 1c, 1916.
Coosia alethes Resser (part), Geol. Soc. Amer. Spec. Pap. 15, p. 71, pl. 13, fig. 10, 1938.

This species, which is the genotype, has been restricted (as far as the original types are concerned) to the cranidium. The pygidium formerly assigned to *Blountia alethes* coming from the same locality as the cranidia, is like the pygidia associated regularly with the *Maryvillia* head in other areas, for which reason it is now reassigned to this species. Walcott's figure was retouched erroneously.

Upper Cambrian, Nolichucky; (loc. 123b) ½ mile east of Rogersville, Tennessee.

Holotype.—U.S.N.M. No. 62826; plesiotypes, No. 62822.

Maryvillia ariston Walcott

Maryvillia ariston Walcott (part), Smithsonian Misc. Coll., vol. 64, No. 5, p. 401, pl. 64, fig. 5, 1916; Resser (part), Geol. Soc. Amer. Spec. Pap. 15, p. 87, pl. 13, figs. 2, 3, 5, 1938.
Asaphiscus? sp. Walcott, Smithsonian Misc. Coll. vol. 64, No. 5, p. 391, pl. 63, figs. 3, 3a, 1916.

This species, like *M. arion,* is restricted to the cranidia, but search through the material in hand revealed the presence of three typical pygidia.

Upper Cambrian, Nolichucky; (locs. 119, 120, 197c) Copper Ridge, 11 and 14 miles northwest of Knoxville, Tennessee.

Holotype.—U.S.N.M. No, 62829; plesiotypes, Nos. 94997, 62810.

Maryvillia masadensis Resser (restricted)

Maryvillia masadensis Resser (part), Geol. Soc. Amer. Spec. Pap. 15, p. 88, pl. 12, fig. 39, 1938.

Several excellent pygidia were discovered in the material from loc. 35s, and a narrow libragene, by its proportions and striated rim seems also to represent the species. If this is a correct reference it is the first libragene discovered for *Maryvillia*. It bears a long genal spine.

Upper Cambrian, Nolichucky; (loc. 22n) Widner Branch, 1½ miles southwest of Masada, and (loc. 35s) 4 miles northeast of Abingdon, Virginia.

Holotype.—U.S.N.M. No. 94964; plesiotypes, No. 102317.

Maryvillia georgica Resser (restricted)

Maryvillia georgica Resser (part), Geol. Soc. Amer. Spec. Pap. 15, p. 88, pl. 12, fig. 41, 1938.

A number of cranidia are in hand but only one imperfect pygidium has been found.

Upper Cambrian, Nolichucky; (loc. 96x) 1 mile north of Adairsville, Georgia.

Holotype.—U.S.N.M. No. 94966.

MEGALOPHTHALMUS Lorenz, 1906

Megalophthalmus shansiensis Resser

Ptychoparia (Liostracus) megalurus Walcott, Proc. U. S. Nat. Mus., vol. 29, p. 9, 1905.

Anomocare megalurus Walcott (part), Research in China, vol. 3, Carnegie Inst. Washington Publ. 54, p. 192, pl. 18, figs. 9-9d, 1913.

Middle Cambrian, Changhia; (loc. C37) 8 miles south of Tinghianghién, Shansi, China.

Cotypes.—U.S.N.M. Nos. 58147-58151.

OLENOIDES Meek, 1877

Olenoides constans Walcott

Neolenus constans Walcott, Smithsonian Misc. Coll., vol. 67, No. 2, p. 45, pl. 6, figs. 7, 7a, 1917.

This species belongs to the group which bridges the gap between *Olenoides* and *Kootenia,* a condition brought about by the degree of pygidial fusion.

Middle Cambrian, Ptarmigan; (loc. 63b) east base of Ptarmigan Peak, 6 miles east of Lake Louise, Alberta.

Holotype.—U.S.N.M. No. 63748.

Olenoides damia (Walcott)

Dorypygia damia Walcott, Smithsonian Misc. Coll., vol. 67, No. 3, p. 102, pl. 11, figs. 7, 7a, 1917.

Middle Cambrian, Ptarmigan; (loc. 62w) Gog Lake, below Wonder Pass, 19 miles southwest of Banff, British Columbia.

Lectotype.—U.S.N.M. No. 64375; paratypes, No. 64374.

Olenoides superbus (Walcott)

Neolenus superbus Walcott (part), Smithsonian Misc. Coll., vol. 53, No. 2, p. 36, pl. 4, figs. 1, 5, 1908.

Neolenus intermedius pugio WALCOTT (part), idem, p. 35, pl. 6, fig. 8, 1908.
Olenoides superbus KOBAYASHI, Journ. Fac. Sci. Imp. Univ. Tokyo, sect. 2, vol. 4, pt. 2, p. 154, 1935.

The numerous species in the Marjum formation are being more precisely discriminated. This necessitates rearrangement of the specimens and assignment of new names to some. *O. inflatus* needs no modification, but *O. superbus* must be restricted.

Middle Cambrian, Marjum; (loc. 11q) Antelope Springs, House Range, Utah.

Lectotype.—U.S.N.M. No. 53383; paratypes, Nos. 53380, 53400.

Olenoides intermedius (Walcott)

Neolenus intermedius WALCOTT (part), Smithsonian Misc. Coll., vol. 53, No. 2, p. 34, pl. 6, figs. 1-3, 1908.
Neolenus superbus WALCOTT (part), idem, p. 36, pl. 4, fig. 3, 1908.
Olenoides intermedius KOBAYASHI, Journ. Fac. Sci. Imp. Univ. Tokyo, sect. 2, vol. 4, pt. 2, p. 154, 1935.

Occurrence same as preceding.

Lectotype.—U.S.N.M. No. 53394; paratypes, Nos. 53384, 53397, 53398.

Olenoides pugio (Walcott)

Neolenus intermedius pugio WALCOTT (part), Smithsonian Misc. Coll., vol. 53, No. 2, p. 35, pl. 6, fig. 9, 1908.
Neolenus intermedius WALCOTT (part) idem, p. 34, pl. 6, fig. 7, 1908.
Olenoides pugio KOBAYASHI, Journ. Fac. Sci. Imp. Univ. Tokyo, sect. 2, vol. 4, pt. 2, p. 154, 1935.

Occurrence same as preceding.

Holotype.—U.S.N.M. No. 53401; plesiotype, No. 53393.

Olenoides marjumensis, new species

Neolenus intermedius WALCOTT (part), Smithsonian Misc. Coll., vol. 53, No. 2, p. 34, pl. 6, figs. 4, 5, 1908.

Walcott noted the fact that this form has six pygidial spines and regarded it as a doubtful example of *O. intermedius*.

The long, slightly extended glabella protrudes considerably beyond the anterior angles. Four pairs of glabellar furrows show faintly. A short occipital spine is present. Longitudinally the glabella is only slightly arched and not at all swollen. Its cross section has low convexity, rather flattened on top, and with a faint keel showing in cross light. Fixigenes at the eyes are less than one-third the glabellar width. Surface covered with the usual lines, in this instance not developed as scales.

The holotype pygidium has six pairs of marginal spines, but evidently lacks axial spines.

Occurrence same as preceding.

Holotypes.—U.S.N.M. No. 53392; paratype, No. 53395.

Olenoides housensis, new species

Neolenus superbus WALCOTT (part), Smithsonian Misc. Coll., vol. 53, No. 2, p. 36, pl. 4, fig. 4, 1908.

A single small cranidium with a protuberant glabella was referred to *O. superbus.* It resembles that species, but *O. marjumensis* even more. However, since its glabella is relatively shorter, a new species must be provided for it.

The glabella is very large and protrudes beyond the anterior angles with an evenly curved outline. Glabellar furrows are exceedingly faint. Occipital furrow strong; occipital ring swollen and extends into a heavy spine of unknown length. Fixigenes at anterior end of eyes reduced to little more than the width of the eye band. Surface lined vertically in the usual manner.

Occurrence same as preceding.

Holotype.—U.S.N.M. No. 53382.

Olenoides decorus, new species

Neolenus intermedius WALCOTT (part), Smithsonian Misc. Coll., vol. 53, No. 2, p. 34, pl. 6, fig. 6, 1908.

A small cranidium figured by Walcott was noted to differ from the other cranidia of *O. intermedius.*

The glabella, rounded in front, extends slightly beyond the anterior angles. A rear pair of furrows shows faintly. The occipital ring is swollen and has a short, stout spine. Longitudinally the head is only slightly convex, and the glabella is also rather flat in cross section.

A four-spined pygidium is assigned to the species.

Middle Cambrian, Marjum; (loc. 3x) 2½ miles east of Antelope Springs, House Range, Utah.

Holotype.—U.S.N.M. No. 53396.

Olenoides horridus (Matthew)

Dorypyge horrida MATTHEW, Trans. Roy. Soc. Canada, ser. 2, vol. 3, sect. 4, p. 190, pl. 4, figs. 3a, b, 1897.

Middle Cambrian, St. John 1d3; Hastings Cove, New Brunswick, Canada.

Holotype.—Roy. Ontario Mus. No. 8410.

Olenoides acadicus (Matthew)

Dorypyge wasatchensis acadica MATTHEW, Trans. Roy. Soc. Canada, ser. 2, vol. 3, sect. 4, p. 188, pl. 4, fig. 1, 1897.

Middle Cambrian, St. John 1d3; Hastings Cove, New Brunswick, Canada.

Holotype.—Roy. Ontario Mus.

ORYGMASPIS Resser, 1937

Orygmaspis weedi, new species

Ptychoparia (*?*) sp. undet. WALCOTT, U. S. Geol. Surv. Monogr. 32, p. 458, pl. 66, fig. 3, 1899.

Walcott recognized the relationships of this species, in the text referring it to *O. eryon* and subsequently labeling the specimens as that species. *O. weedi* occurs in crystalline limestone surfaces on thin vaughnite layers, and is represented by several cranidia on the two pieces of rock in the collections. In addition there are several libragenes and one pygidium. This species resembles *O. eryon,* but is relatively shorter and has a deeper anterior furrow, which thus defines the rim more clearly. The outer surface appears to be smooth, but large exfoliated specimens have anastomosing lines on the preglabellar area, becoming strongest toward the anterior angles. Likewise on the ocular platforms of the libragenes, similar lines radiate from the eyes. The pygidium has a high axis and gently convex pleural lobes on which both the pleural grooves and furrows are clearly indicated.

Upper Cambrian, Dry Creek; Crowfoot Ridge, Yellowstone National Park, Montana.

Holotype.—U.S.N.M. No. 102318.

PAGETIA Walcott, 1916

Pagetia orientalis (Walcott)

Microdiscus orientalis WALCOTT, Proc. U. S. Nat. Mus., vol. 29, p. 24, 1905; Research in China, vol. 3, Carnegie Inst. Washington Publ. 54, p. 102, pl. 7, fig. 10, 1913.

Middle Cambrian, Kisingling; (loc. C32) Drift, Nanho, 1 mile south of Chonping, Shensi, China.

Holotype.—U.S.N.M. No. 57844.

PARAMANSUYELLA Endo, 1937

Paramansuyella taianensis, new species

Mansuyia orientalis Sun, Geol. Surv. China, Pal. Sinica, ser. B, vol. 7, fasc. 2, p. 58, pl. 2, figs. 20-24, 1935.

This species is characterized by the width of the pygidium and the divergence of the pygidial spines. The brim is stout and simple, and the eyes of normal size and position.

Upper Cambrian, Tawenkou; Tawenkou, Taian, China.

Cotypes.—Tsing Hua Univ. Nos. S1156-S1160.

PEISHANIA Resser and Endo, 1935

Peishania talignensis (Dames)

Liostracus talingensis Dames, von Richthofen's China, vol. 4, p. 19, pl. 1, fig. 20, 1883.

Ptychoparia talingensis Kobayashi, Journ. Geol. Soc. Japan, vol. 44, No. 524, p. 432, pl. 17, fig. 11, 1937.

Middle Cambrian, Taitzu; Taling, south of Hsiaoshih, Liau-tung, Manchoukuo.

Holotype.—Natur. Mus. Berlin.

PERIOURA Resser, 1938

Perioura is now identified in the Cordilleran region, and thus affords another point of correlation with the Appalachians. Late Middle Cambrian fossils are just becoming known, although several sizeable faunas are described. This genus includes *Mcnairia* Deiss.

Perioura inornata (Deiss)

Mcnairia inornata Deiss, Geol. Soc. Amer. Spec. Pap. 18, p. 104, pl. 17, figs. 27-30, 1939.

Middle Cambrian, Steamboat; Cliff Mountain, Chinese Wall, Lewis and Clark Range, Montana.

Holotype.—Montana Univ. No. T1140; paratype, No. T1141.

Perioura callas (Walcott)

Marjumia callas Walcott, Smithsonian Misc. Coll., vol. 64, No. 5, p. 402, pl. 65, figs. 3-3b, 1916.

Middle Cambrian, Marjum; (loc. 31r) 1 mile southeast of Marjum Pass, House Range, Utah.

Holotype.—U.S.N.M. No. 62839; paratypes, Nos. 62840, 62841.

PHYLACTERUS Raymond, 1924

Phylacterus welleri (Raymond)

Microdiscus ? sp. undet. Weller, Geol. Surv. New Jersey, Pal., vol. 3, p. 114, pl. 3, fig. 11, 1903.

Pseudosalteria welleri RAYMOND, Proc. Boston Soc. Nat. Hist., vol. 37, No. 4. p. 399, 1924.

Raymond judged the relationship of this trilobite from Weller's incomplete figure. Several specimens were collected by Dickhout in 1901 at Weller's locality. They all have a rim which evidently was lacking in the incomplete holotype. The presence of the rim places the species in *Phylacterus* rather than *Pseudosalteria.*

Upper Cambrian, Kittatinny; (loc. 11c) quarry at Newton, Essex County, New Jersey.

Holotype.—Geol. Surv. New Jersey.

PLATYCOLPUS Raymond, 1913

Platycolpus barabuensis (Winchell)

Ptychaspis barabuensis WINCHELL (part), Amer. Journ. Sci., vol. 37, p. 230, 1864.

Platycolpus barabuensis RAYMOND, Bull. Victoria Mus. vol. 1, p. 64, 1913.

This species has never been illustrated. It is a particularly interesting form because of its large size and early age. Winchell, however, had other forms mixed with it that have now been referred to other genera. In 1882 Whitfield described a *Platycolpus* species from the younger St. Lawrence (Mendota) dolomite, applying Winchell's name. Subsequently the St. Lawrence form became the basis of the concept of *P. barabuensis,* because it was illustrated and the original types were not. At the same time Whitfield named the large species in the Mendota dolomite *P. eatoni.* It happens that *P. eatoni* Whitfield and *P. barabuensis* Winchell resemble each other more than the *P. barabuensis* of Whitfield. There is one or more smaller species in the Franconia (Devils Lake) sandstone, and these forms resemble the small one to which Whitfield erroneously applied the name *barabuensis.* This confusion can easily be resolved by restricting the name *P. barabuensis* to the specimens among Winchell's types that belong to *Platycolpus,* and give the form described by Whitfield a new name.

As now constituted *P. barabuensis* is a large species, perhaps the largest yet found. Neither the cranidium nor the pygidium have as great convexity as the almost equally large *P. eatoni* from the St. Lawrence. Only the anterior half of a cranidium has been located in the collections in hand from the vicinity of the type locality. This cranidium has large prominent palpebral lobes which attain their prominence chiefly by the elevation of their rear extremities. The brim is wide, heavily striated, and set in a vertical position that makes it appear to be pressed back against the front of the glabella. A single fragment seems to indicate that the librigenes were large and long,

as they are in *P. eatoni*. The pygidium is well represented both by the Winchell lectotype and by specimens in the National Museum collections. It is characterized by a wide, stout axis on which several segments are faintly outlined. Of course, it must be remembered that all these specimens in a coarse sandstone matrix are impressions of the underside of the test, so that all furrows are accentuated. If the outer surface of the test or an impression of it was preserved, the trilobite would appear much smoother and with almost no furrows. The axis stands above the pleural platforms. They in turn are little differentiated from the wide border.

Upper Cambrian, Franconia (Devils Lake); (loc. 81) 1 mile northeast of Devils Lake; and $\frac{1}{4}$ mile southeast of Woods Quarry, Baraboo, Wisconsin.

Lectotype.—Univ. Michigan No. 4879; cast, U.S.N.M. No. 102319.

Platycolpus whitfieldi, new species

Dikelocephalus barabuensis WHITFIELD, Ann. Rep. Geol. Surv. Wisconsin for 1877, p. 63, 1878; Geol. Wisconsin, vol. 4, p. 201, pl. 4, figs. 6-9, 1882.

When Whitfield described the species found in the St. Lawrence (Mendota) dolomite near Baraboo, he applied Winchell's name to a species of *Platycolpus*. As previously stated, this species is much smaller and otherwise distinct so that it must have a new name. While typical of the genus in all respects, *P. whitfieldi* is characteristic of a rather distinct group of species. The glabella is large, extending nearly the full length of the cranidium. Transversely the cranidium is moderately convex, but longitudinally it is more highly arched, particularly in its anterior half. The thickened rim stands vertically, and at its inner edge rises sharply above a very narrow preglabellar area. The rim is striated as usual. Narrow fixigenes remain immediately in front of the eyes. The occipital and the rear pair of glabellar furrows are visible. It is in the libragene that the greatest distinction is found when this species is compared with either *P. barabuensis* or *P. eatoni*. In this case the libragene constitutes nearly a quarter circle, hence is shorter than the others. It has a wide rim that is sharply curved to the genal angle, where a slight, blunt spine may be present. The pygidium is normal, with a rather rapidly tapering axis extending about two-thirds the length of the pygidium. As in the cranidium, several axial and pleural furrows are visible in the pygidium. The pleural platforms and the border constitute a convex area.

Upper Cambrian, St. Lawrence (Mendota); Eikey's Quarry, near Baraboo, Wisconsin.

Cotypes.—Univ. California No. 1214; cast, U.S.N.M. No. 98261.

PLETHOPELTIS Raymond, 1913

Plethopeltis saratogensis (Walcott)

Ptychoparia (Agraulos) saratogensis Walcott, U. S. Geol. Surv. Bull. 30, p. 21, 1886.

Agraulos saratogensis Walcott, Proc. U. S. Nat. Mus., vol. 13, p. 276, pl. 21, fig. 14, 1890; (part), Smithsonian Misc. Coll., vol. 57, No. 9, p. 269, pl. 43, figs. 11-13a, 15, 15a, 1912.

Plethopeltis saratogensis Raymond, Victoria Mem. Mus. Bull. 1, p. 64, 1913; Proc. Boston Soc. Nat. Hist., vol. 37, No. 4, p. 412, 1924.

Walcott failed to observe that his holotype is an exfoliated specimen. In spite of that fact it has no glabellar furrows, although faint impressions were put into the illustration. Some other specimens do show shallow furrows on exfoliated surfaces, but on the outside of the test even the dorsal furrow should be shallow. Fragments of test remaining indicate that the *P. saratogensis* had ornamentation, but it is not clear what its pattern is. The types are restricted to one species, but several others are found among the unfigured specimens.

Upper Cambrian, Potsdam (Hoyt member); (loc. 76) 4 miles west of Saratoga Springs, New York.

Holotype.—U.S.N.M. No. 23863 (58558); plesiotypes, Nos. 58559, 58560, 58562.

Plethopeltis walcotti Raymond

Plethopeltis walcotti Raymond, Proc. Boston Soc. Nat. Hist., vol. 37, No. 4, p. 414, pl. 12, figs. 20, 24, 1924.

Kaniniella? walcotti Kobayashi, Jap. Journ. Geol. and Geogr. vol. 15, Nos. 3, 4, p. 190, 1938.

It is a question whether Raymond did not found this species on the same form as *P. saratogensis*, since that species too has no glabellar furrows. This problem cannot be solved until the types can be compared.

Occurrence same as preceding.

Holotype.—M.C.Z. No. 1730; paratype, No. 1731.

Plethopeltis granulosa, new species

Ptychaspis speciosus Walcott (part), Smithsonian Misc. Coll., vol. 57, No. 9, p. 272, pl. 43, figs. 18, 18a, 1912.

Agraulos saratogensis Walcott (part), Smithsonian Misc. Coll., vol. 57, No. 9, p. 269, pl. 43, figs. 14, 14a, 1912.

The pygidium assigned by Walcott to the saukian trilobite he placed in *Ptychaspis speciosus* seems to belong with a cranidium lying near it in the matrix. A fragment of a *Saukia* pygidium lies near both. At first it was thought that this pygidium may represent *P. saratogensis*, even though it is granulose, but comparisons re-

vealed that neither the head nor the tail is that species. One of the cranidia illustrated as *P. saratogensis* apparently is the same species as that lying near the pygidium. Thus constituted, the species has definite characteristics.

Size and shape are normal for both head and tail. The rear pair of furrows are rather deep, and a second pair is visible on the outer surface. The brim sets at a less steep angle to the horizontal than in *P. saratogensis,* and in itself is less convex. Eyes normal in size, situated slightly anterior to the midpoint of glabella. Surface of cranidium finely granulose; brim marked by strong striations roughly parallel to the front margin.

The pygidial axis is wide and long, and stands well above the convex pleural platforms. Axis strongly divided by furrows, and both pleural grooves and furrows are well developed. Surface granulose, and the steep border slope is striated like the brim.

Upper Cambrian, Potsdam (Hoyt member); (loc. 76) 4 miles west of Saratoga Springs, New York.

Holotype.—U.S.N.M. No. 58561; paratype, No. 58565.

PROASAPHISCUS Resser and Endo, 1935

Proasaphiscus eriopia (Walcott)

Anomocare eriopia Walcott, Proc. U. S. Nat. Mus., vol. 30, p. 582, 1906.

Ptychoparia (Emmrichella) eriopia Walcott, Research in China, vol. 3, Carnegie Inst. Washington Publ. 54, p. 136, pl. 13, figs. 4, 4a, 1931.

Even though the cranidium is incomplete, it seems that the species should be assigned to the same genus as *P. ephori.*

Middle Cambrian, Changhia; (loc. C23) 1 mile east-southeast of Changhia, Shantung, China,

Holotype.—U.S.N.M. No. 57970; paratype, No. 57971.

Proasaphiscus rectangularis (Sun)

Lisania rectangularis Sun, Geol. Surv. China, Pal. Sinica, ser. B, vol. 1, fasc. 4, p. 55, pl. 4, figs. 2a, b, 1924.

Middle Cambrian, Nanchuang; Chengshan, near Chaokouchuang, Chihli, China.

Cotypes.—Geol. Surv. China Nos. 575, 576.

PROBOWMANIA Kobayashi, 1935

Probowmania fongi (Sun)

Ptychoparia fongi Sun, Geol. Surv. China, Pal. Sinica, ser. B, vol. 1, fasc. 4, p. 40, pl. 2, figs. 10a, b, 1924.

Lower Cambrian, Manto; Chengshan, Chaokouchuang, Chihli, China.

Cotypes.—Geol. Surv. China Nos. 531, 532.

Probowmania granosa (Walcott)

Ptychoparia granulosa WALCOTT, Proc. U. S. Nat. Mus., vol. 29, p. 78, 1905.

Ptychoparia granosa WALCOTT, Smithsonian Misc. Coll., vol. 57, No. 4, p. 77, pl. 14, fig. 8, 1911; Research in China, vol. 3, Carnegie Inst. Washington Publ. 54, p. 131, pl. 12, fig. 7, 1913.

Lower Cambrian, Manto; (loc. C17) Changhia, Shantung, China.

Holotype.—U.S.N.M. No. 57602.

PROSAUKIA Ulrich and Resser, 1933

Prosaukia barabuensis, new species

Dicellocephalus pepinensis WINCHELL (part), Amer. Journ. Sci., vol. 37, p. 229, 1864 [head].

Dicellocephalus minnesotensis WINCHELL (part), idem. p. 229, 1864 [tail].

Ptychaspis barabuensis WINCHELL (part), idem, p. 230, 1864 [cheek].

Saukia crassimarginata ? WALCOTT (part), Smithsonian Misc. Coll., vol. 57, No. 13, p. 377, pl. 65, fig. 9, 1914.

Several pygidia are available, and libragenes described by Winchell seem to be referable to the species. The description of the species, therefore, is based on the pygidium, while the libragenes of Winchell are merely referred to it. This pygidium has a rather long and stout axis in which at least five rings are visible. The axis stands high above the pleural platforms and terminates in a pronounced postaxial ridge. The pleural platforms are small, in front equaling about the width of the axis, but tapering to extinction anterior to the end of the axis. Pleural grooves and furrows are strong, extending practically to the outer margins. The furrows subdivide the pleura subequally. The border is increasingly concave toward the rear, where the border width is about two-thirds the axial length.

Upper Cambrian, Franconia (Mazomanie member); (loc. 81b) near Devils Lake, Wisconsin.

Holotype.—U.S.N.M. No. 58626; paratypes, Univ. Michigan Nos. 21216, 21210, 21217.

Prosaukia newtonensis (Weller)

Dikelocephalus newtonensis WELLER, Geol. Surv. New Jersey, Pal., vol. 3, p. 121, pl. 3, figs. 1-7, 1903.

Calvinella newtonensis WALCOTT (part), Smithsonian Misc. Coll., vol. 57, No. 13, p. 389, pl. 70, figs. 7, 8, 11, 11a, 1914.

Upper Cambrian, Kittatinny; (loc. 11c) quarry near Newton, Sussex County, New Jersey.

Holotype and paratypes.—Geol. Surv. New Jersey.

Prosaukia welleri, new species

Calvinella newtonensis WALCOTT (part), Smithsonian Misc. Coll., vol. 57, No. 13, p. 389, pl. 70, figs. 9, 10, 1914.

Two of the specimens, a head and a libragene, from the same locality as *P. newtonensis,* were referred to that species by Walcott. Two other species still remain to be described, showing that the saukian trilobites were apparently as prolific in New Jersey as in Wisconsin.

P. welleri is characterized by its large size and the strongly ornamented surface. Granules cover the elevated parts of the cranidium. The neck spine is very short. On the libragene the granules are present only on the ridge immediately in front of the occipital furrow, and then pass into anastomosing lines, which run roughly parallel to the outer margin and cover the ocular platform.

Upper Cambrian, Kittatinny; (loc. 11c) quarry near Newton, Sussex County, New Jersey.

Holotype.—U.S.N.M. No. 58678; paratype, No. 58679.

Prosaukia tribulis (Walcott)

Dicellocephalus tribulis WALCOTT, Smithsonian Misc. Coll., vol. 57, No. 9, p. 274, pl. 44, figs. 8, 8a, 1912.

Dikelocephalus ? tribulis WALCOTT, ibid., No. 13, p. 372, pl. 63, figs. 8-10a, 1914.

It cannot now be determined whether this species is fully typical of the genus. One cannot be sure of certain details owing to the fact that the genotype and other upper Mississippi Valley species are exfoliated, while *P. tribulis* is represented by unexfoliated specimens in a limestone matrix.

Upper Cambrian, Potsdam (Hoyt member); (loc. 76) 4 miles west of Saratoga Springs, New York.

Holotype.—U.S.N.M. No. 58578; paratype, No. 58617.

PSILASPIS Resser and Endo, 1935

Psilaspis RESSER and ENDO, *in* Kobayashi, Journ. Fac. Sci. Imp. Univ. Tokyo, sect. 2, vol. 4, pt. 2, p. 286, 1935; Manchurian Sci. Mus. Bull. 1, pt. 2, p. 268, 1937.

Lioparella KOBAYASHI, Journ. Geol. Soc. Japan, vol. 44, No. 524, p. 429, 1937.

Psilaspis alcinoe (Walcott)

Anomocare alcinoe WALCOTT, Proc. U. S. Nat. Mus., vol. 29, p. 47, 1905; Research in China, vol. 3, Carnegie Inst. Washington Publ. 54, p. 187, pl. 18, figs. 6-6b, 1913.

Liostracus latus LORENZ, Deutsch. Geol. Ges. Zeitschr., vol. 58, No. 2, p. 81, pl. 5, fig. 15, 1906.

Middle Cambrian, Changhia; (loc. C57) Tungyü, south of Sintai, Shantung, China.

Holotype.—U.S.N.M. No. 58137; paratypes, Nos. 58138, 58139; plesiotypes, Freiburg in Br. Mus.

Psilaspis flava (Walcott)

Anomocare flava WALCOTT, Proc. U. S. Nat. Mus., vol. 30, p. 583, 1906; Research in China, vol. 3, Carnegie Inst. Washington Publ. 54, p. 190, pl. 18, figs. 8-8c, 1913.

Saimachia ? flava KOBAYASHI, Journ. Geol. Soc. Japan, vol. 44, No. 524, p. 430, 1937.

Middle Cambrian, Changhia; (loc. C72) Fang-lan-chön, Shansi.

Cotypes.—U.S.N.M. Nos. 58143, 58146.

Psilaspis blautoeides (Lorenz)

Lioparia blautoeides LORENZ, Deutsch. Geol. Ges. Zeitschr., vol. 58, p. 78, pl. 6, figs. 1-3, 1906; KOBAYASHI, Journ. Fac. Sci. Imp. Univ. Tokyo, sect. 2, vol. 4, pt. 2, p. 240, 1935.

Anomocarella baucis WALCOTT, Research in China, vol. 3, Carnegie Inst. Washington Publ. 54, p. 7, 1913.

Anomocare sp. undet. WALCOTT, idem, p. 194, pl. 19, fig. 5, 1913.

Middle Cambrian, Changhia; northern slopes of the Taishan, south of Tsi-nan-fu, Shantung, China.

Cotypes.—Freiburg Mus.; cast, U.S.N.M. No. 102321.

Psilaspis speciosa (Lorenz)

Anomocare speciosum LORENZ, Deutsch. Geol. Ges. Zeitschr. vol. 58, p. 77, pl. 5, figs. 6, 7, 1906.

Anomocarella speciosa WALCOTT, Research in China, vol. 3, Carnegie Inst. Washington Publ. 54, p. 205, pl. 20, fig. 8, 1913.

Anomocarella thraso WALCOTT (part), idem, p. 208, pl. 19, fig. 14a, 1913.

Anomocarella albion WALCOTT (part), idem, p. 195, pl. 20, fig. 1e, 1913.

Middle Cambrian, Changhia; Wang-chuang, east of Sintai; (loc. C7) 2 miles and (loc. C4) 3 miles southwest of Yenchou, Shantung, China.

Cotypes.—Freiburg Mus.; cast, U.S.N.M. No. 58540; plesiotypes, U.S.N.M. Nos. 58184, 58191.

Psilaspis suni, new species

Anomocare flava SUN, Geol. Surv. China, Pal. Sinica, ser. B, vol. 1, fasc. 4, p. 80, pl. 5, figs. 8-8c, 1924.

This species seems to be clearly referable to *Psilaspis,* even though the drawings illustrating it are rather poor. It certainly cannot be *P. flava,* although there is considerable resemblance. *P. suni* has a straighter anterior margin and a somewhat larger glabella. The pygidium likewise has a stouter axis.

Middle Cambrian, Nanchuang; 2 miles from Chaokouchuang, Kaiping basin, Chihli, China.

Cotypes.—Geol. Surv. China Nos. 619-622.

Psilaspis walcotti (Kobayashi)

Anomocare latelimbatum WALCOTT (part), Research in China, vol. 3, Carnegie Inst. Washington Publ. 54, p. 191, pl. 18, figs. 2d, 2e, 1913.

Lioparella walcotti KOBAYASHI, Journ. Geol. Soc. Japan, vol. 44, No. 524, p. 429, 1937.

Middle Cambrian, Changhia; (loc. C52) 3 miles northeast of Sin-tai-hien, Shantung, China.

Cotypes.—U.S.N.M. Nos. 58131, 58132.

Psilaspis baucis (Walcott)

Anomocarella baucis WALCOTT, Proc. U. S. Nat. Mus., vol. 29, p. 55, 1905; Research in China, vol. 3, Carnegie Inst. Washington Publ. 54, p. 196, pl. 20, figs. 2, 2a, 1913.

Upper Cambrian, Kaolishan; (loc. C36) near Chaumitien, Changhia district, Shantung, China.

Cotypes.—U.S.N.M. Nos. 58193, 58194.

Psilaspis contigua (Walcott)

Anomocarella contigua WALCOTT, Proc. U. S. Nat. Mus., vol. 30, p. 584, 1906.

Anomocarella albion WALCOTT (part), Research in China, vol. 3, Carnegie Inst. Washington Publ. 54, p. 195, pl. 20, figs. 1a-1d, 1913.

Since Walcott included two species in *P. albion,* it is desirable to resurrect the name *contigua,* which he suppressed.

Middle Cambrian, Changhia; (loc. C2) 2 miles south of Yen-chuang, Sintai district, Shantung, China.

Cotypes.—U.S.N.M. Nos. 58187-58190.

Psilaspis vesta (Walcott)

Ptychoparia vesta WALCOTT, Proc. U. S. Nat. Mus., vol. 30, p. 590, 1906.

Conokephalina vesta WALCOTT, Research in China, vol. 3, Carnegie Inst. Washington Publ, 54, p. 139, pl. 13, figs. 9-9b, 1913.

Middle Cambrian, Changhia; (loc. C69) 4 miles east of Fang-lan-chön, Shansi, China.

Cotypes.—U.S.N.M. Nos. 57974-57977.

Psilaspis albion Walcott

Anomocarella albion WALCOTT, Proc. U. S. Nat. Mus., vol. 29, p. 54, 1905; (part) Research in China, vol. 3, Carnegie Inst. Washington Publ. 54, p. 195, pl. 20, fig. 1, 1913.

Middle Cambrian, Changhia; (loc. C57) 4 miles north of Sintai, Shantung, China.

Holotype.—U.S.N.M. No. 58186.

Psilaspis decelus (Walcott)

Anomocare decelus WALCOTT, Proc. U. S. Nat. Mus., vol. 29, p. 52, 1905.
Coosia decelus WALCOTT, Research in China, vol. 3, Carnegie Inst. Washington Publ. 54, p. 212, pl. 21, fig. 8, 1913.

Middle Cambrian, Changhia (loc. C9) 3 miles southwest of Yenchuang, Sintai district, Shantung, China.
Holotype.—U.S.N.M. No. 58227.

Psilaspis bigsbyi (Walcott)

Anomocare bigsbyi WALCOTT, Proc. U. S. Nat. Mus., vol. 30, p. 581, 1906.
Anomocarella bigsbyi WALCOTT, Research in China, vol. 3, Carnegie Inst. Washington Publ. 54, p. 198, pl. 21, figs. 3-3b, 1913.

Middle Cambrian, Changhia; (loc. C71) 4 miles southwest of Tungyü, Shansi, China.
Cotypes.—U.S.N.M. Nos. 58219-58221.

Psilaspis butes (Walcott)

Anomocare (?) butes WALCOTT, Proc. U. S. Nat. Mus., vol. 29, p. 49, 1905.
Anomocarella butes WALCOTT, Research in China, vol. 3, Carnegie Inst. Washington Publ. 54, p. 199, pl. 19, figs. 7-7d, 1913.

Middle Cambrian, Changhia; (loc. C5) 3 miles southwest of Yenchuang; (loc. C52) 3 miles northeast of Sintai, Shantung, China.
Cotypes.—U.S.N.M. Nos. 58169-58172; plesiotype, No. 58168.

Psilaspis expansas (Kobayashi)

Lioparia expansus KOBAYASHI, Journ. Fac. Sci. Imp. Univ. Tokyo, sect. 2, vol. 4, pt. 2, p. 240, pl. 19, fig. 13, 1935.
Lioparella expansa KOBAYASHI, Journ. Geol. Soc. Japan, vol. 44, No. 524, p. 429, 1937.

Middle Cambrian, Taiki (*Solenoparia* zone); Doten, south Chosen.
Holotype.—Geol. Inst. Univ. Tokyo.

Psilaspis tatian (Walcott)

Anomocare tatian WALCOTT, Proc. U. S. Nat. Mus., vol. 29, p. 53, 1905.
Anomocarella tatian WALCOTT, Research in China, vol. 3, Carnegie Inst. Washington Publ. 54, p. 206, pl. 21, figs. 1-1b, 1913.

Middle Cambrian, Changhia; (loc. C23) 1 mile southeast of Changhia, Shantung, China.
Holotype.—U.S.N.M. No. 58198; paratypes, Nos. 58199, 58200.

PTYCHOPLEURITES Kobayashi, 1936

This genus is rare, although it occurs from Texas to the Canadian Rockies.

Ptychopleurites eurekensis (Kobayashi)

Richardsonella eurekensis KOBAYASHI, Jap. Journ. Geol. and Geogr., vol. 12, Nos. 3-4, p. 55, pl. 9, fig. 9, 1935.

Upper Cambrian, Hamburg; (loc. 25L) east of Hamburg Mine, Eureka district, Nevada.

Holotype.—U.S.N.M. No. 93052.

QUADRATICEPHALUS Sun, 1924

Quadraticephalus SUN, Geol. Surv. China, Pal. Sinica, ser. B, vol. 1, fasc. 4, p. 61, 1924; KOBAYASHI, Jap. Journ. Geol. and Geogr., vol. 11, Nos. 1, 2, p. 119, 1933.

Changia SUN, Geol. Surv. China, Pal. Sinica, ser. B, vol. 1, fasc. 4, p. 59-60, 1924.

Sun recognized the close similarity of *Changia chinensis* to *Quadraticephalus walcotti* but regarded their slight differences as of generic rank. He states that *Quadraticephalus*

> is similar to the genus *Chuangia* in form, but the presence of the median longitudinal ridge, subrectangular glabella with parallel sides and punctate character of the surface serves to distinguish it.

Sun evidently meant to write *Changia* and not *Chuangia*.

These distinguishing features are not of generic rank, but merely separate the species. Both species established as respective genotypes have essentially the same glabellar structure, the slight constriction of its sides in *Q. chinensis* being more an optical illusion produced by the increase in depth of furrows than an actuality. At any rate, differences of this feature to the degree shown in the species now known are never of more than specific importance. Likewise the presence or absence of a keel on the glabella, which otherwise is constructed on the same pattern, is only of specific value. Punctate structure of the trilobite test is rarely found on the outer surface of Cambrian species. On the other hand, almost any species that has broad unfurrowed surfaces will show punctate structure when preserved in a certain fashion. Punctation most often appears when the fossil is an impression of the under side of the test. At other times this feature is conspicuous when one or more layers of the test are peeled off so that the surface of the fossil is composed of a test layer below its outer surface. All the specimens of *Quadraticephalus* in our collections show the punctation only when the outer layers of the test are peeled off.

Quadraticephalus is chosen as the name to be retained, in spite of its length, because *Changia* is similar and easily confused with *Chuangia* and *Changhia,* both well-established genera. Moreover,

Quadraticephalus is much better known and its use more widely spread in literature than *Changia*.

Changia chinensis Sun and *C. shakoutunensis* Sun both become *Quadraticephalus*.

Genotype.—*O. walcotti* Sun.

Quadraticephalus bianos (Walcott)

Anomocare bianos Walcott, Proc. U. S. Nat. Mus., vol. 29, p. 48, 1905.

Coosia ? bianos Walcott, Research in China, vol. 3, Carnegie Inst. Washington Publ. 54, p. 210, pl. 21, figs. 10, 10a, 1913.

Ptychaspis ? sp. undet. Walcott (part), idem, p. 186, pl. 17, fig. 1; pl. 21, fig. 14, 1913.

Upper Cambrian, Fengshan; (loc. C64) 3 miles southwest of Yenchuang, Shantung, China.

Holotype.—U.S.N.M. No. 58228; paratypes, Nos. 58229, 58113, 58127.

Quadraticephalus chosensis (Kobayashi)

Changia chosensis Kobayashi, Journ. Fac. Sci. Imp. Univ. Tokyo, sect. 2, vol. 4, pt. 2, p. 319, pl. 5, figs. 1, 2, 1935.

Upper Cambrian, Katsetsu (*Asioptychaspis* zone); Doten, south Chosen.

Holotype and paratypes.—Geol. Inst. Univ. Tokyo.

Quadraticephalus fengshanensis (Sun)

Ptychaspis ? fengshanensis Sun, Geol. Surv. China, Pal. Sinica, ser. B, vol. 7, fasc. 2, p. 31, pl. 4, fig. 13, 1935.

Upper Cambrian, Fengshan; Yehli, Kaiping basin, Hopei, China.

Holotype.—Nat. Peiping Univ. No. S1215.

SAUKIA Walcott, 1914

Saukia speciosa (Walcott)

Ptychasphis speciosus Walcott, 32d Rep. New York State Mus. Nat. Hist., p. 131, 1879; Lesley, Geol. Surv. Pennsylvania Rep. P 4, p. 830, 1889; Walcott (part), Smithsonian Misc. Coll., vol. 57, No. 9, p. 272, pl. 43, figs. 16, 16a, 17, 19, 1912.

Upper Cambrian, Potsdam (Hoyt member); (loc. 76) 4 miles west of Saratoga Springs, New York.

Lectotype.—U.S.N.M. No. 58563; paratype, No. 58564.

Saukia eboracensis, new species

Lonchocephalus calciferus Walcott (part), Smithsonian Misc. Coll., vol. 57, No. 9, p. 270, pl. 43, fig. 9, 1912.

Dicellocephalus hartti Walcott (part), idem, p. 273, pl. 44, figs. 7, 7a, 1912.

Dikelocephalus hartti WALCOTT (part), ibid., No. 13, p. 368, pl. 63, figs. 7, 7a, 1914.

A libragene and a pygidium, as indicated in the bibliography, apparently belong together. Several small unillustrated cranidia also are candidates for the species. As the matter now stands the pygidium may be chosen as the type, and final assignment of cranidium awaits proper study of the fauna.

Axis prominent, extending about two-thirds the pygidial length, and connected with the rear edge by a sharp postaxial ridge. Axial furrows well developed. Pleural platforms small, sharply convex. Both the pleural grooves and furrows are clearly defined and run nearly to the margin, Pygidium as a whole very convex.

The libragene is characterized by a very long genal spine. Its ocular platform is covered by anastomosing lines that form a rather definite network. Toward the brim these lines become irregular striations. Eyes rather large.

Upper Cambrian, Potsdam (Hoyt member); 1 mile west of Saratoga Springs, New York.

Holotype.—U.S.N.M. No. 58577; paratype, No. 58556.

SEMNOCEPHALUS, new genus

Several species of trilobites with surface granulation were long ago described from the Yellowstone Park. They are characterized by their plump appearance. Similar species are now also in hand from the Canadian Rockies, and representatives of the genus may be expected elsewhere in the older Upper Cambrian beds.

Diagnosis.—Trilobites of average size. Cranidium alone known. The glabella is large, tapering to a rounded front. Glabellar furrows very shallow or wanting. Dorsal furrow clearly defined, and occipital furrow wide and rather deep. Fixigenes average a little more than half the glabellar width, and are slightly convex. Eyes small, situated about the midpoint of the cranidium. Faint eye lines traceable. Brim width slightly more than a third the glabellar length. It consists of a thickened elevated rim and a narrower preglabellar area. Suture intramarginal for some distance.

Owing to the down-turned anterior angles the front of the head is convex, but while the glabella and fixigenes are both convex across the eyes, the total relief thus obtained is not great. Longitudinally there is more convexity, attained by a gentle curvature of most of the glabella, but which increases rapidly in the anterior fourth and is further accentuated by the downward slope of the brim. Surface granulose.

Genotype.—*Solenopleura* (*?*) *weedi* Walcott (part).

Name.—σεμνος = portly; κεφαλη = head.

Semnocephalus weedi (Walcott)

Solenopleura ? weedi Walcott (part), U. S. Geol. Surv. Monogr. 32, pt. 2, p. 464, pl. 65, fig. 9, 1899.

Upper Cambrian, Pilgrim; Crowfoot Ridge, Gallatin Range, Yellowstone National Park, Montana.

Holotype.—U.S.N.M. No. 35236.

Semnocephalus minor, new species

Solenopleura ? weedi Walcott (part), U. S. Geol. Surv. Monogr. 32, pt. 2, p. 464, pl. 65, fig. 9a, 1899.

This name is applied to the smaller of the specimens figured by Walcott. It has smaller and fewer granules, and has a shorter glabella, more rounded in frontal outline.

Upper Cambrian, Pilgrim; Crowfoot Ridge, Yellowstone National Park, Montana.

Holotype.—U.S.N.M. No. 102322.

SHIRAKIELLA Kobayashi, 1935

Shirakiella carme (Walcott)

Anomocarella carme Walcott, Proc. U. S. Nat. Mus., vol. 29, p. 56, 1905.

Coosia carme Walcott, Research in China, vol. 3, Carnegie Inst. Washington Publ. 54, p. 211, pl. 21, fig. 7, 1913.

Upper Cambrian, Fengshan; (loc. C38) (*Asioptychaspis* zone) Chaumitien, Shantung, China.

Holotype.—U.S.N.M. No. 58226.

SOLENOPARIA Kobayashi, 1935

Solenoparia intermedia (Walcott)

Ptychoparia (*Liostracus*) *intermedia* Walcott, Proc. U. S. Nat. Mus., vol. 30, p. 592, 1906.

Solenopleura intermedia Walcott, Research in China, vol. 3, Carnegie Inst. Washington Publ. 54, p. 169, pl. 17, figs. 16, 16a, 1913.

Shumardia sp. undet. Walcott, idem, pl. 7, fig. 9, 1913.

Middle Cambrian, Changhia; (loc. C51) Chaumitien, Shantung, China.

Cotypes.—U.S.N.M. Nos. 58072, 58073, 57843.

Solenoparia pauperata (Walcott)

Solenopleura pauperata WALCOTT, Proc. U. S. Nat. Mus., vol. 30, p. 593, 1906; Research in China, vol. 3, Carnegie Inst. Washington Publ. 54, p. 169, pl. 17, fig. 18, 1913.

Middle Cambrian, Changhia; (loc. C71) 4 miles southwest of Tungyü, Shansi, China.

Holotype.—U.S.N.M. No. 58074.

Solenoparia tolus (Walcott)

Ptychoparia tolus WALCOTT, Proc. U. S. Nat. Mus., vol. 29, p. 82, 1905; Research in China, vol. 3, Carnegie Inst. Washington Publ. 54, p. 134, pl. 12, fig. 13, 1913.

Middle Cambrian, Changhia; (loc. C52) 3 miles northeast of Sin-tai-hien, Shantung, China.

Holotype.—U.S.N.M. No. 57956.

SOLENOPLEURELLA Poulsen, 1927

Solenopleurella resseri (Miller)

Bolaspis ? resseri MILLER, Journ. Pal., vol. 10, No. 1, p. 27, pl. 8, fig. 39, 1936.

Middle Cambrian, Wolsey; south fork of Teton Creek, Teton Mountains, Wyoming.

Cotypes.—Columbia Univ. No. 12608.

STEPHENOCARE Monke, 1903

Stephenocare chaoi, new species

Stephenocare richthofeni SUN, Geol. Surv. China, Pal. Sinica, ser. B, vol. 1, fasc. 4, p. 32, pl. 2, figs. 5a-c, 1924.

This species, according to the drawings published by Sun, differs from *S. richthofeni* in several respects. The marginal spines on the rim appear to be shorter and differently spaced, and the rim itself, as drawn, appears thicker. Granules are more abundant, the rear pair of glabellar furrows more recurved, and the glabella less tapered. Spines are wanting along the rear edge, but they may simply have been overlooked in making the drawing.

Although the pygidium is incomplete, so that the length of the spines cannot be determined, it appears that the pleura are rather heavy. This species is considerably larger than *S. richthofeni.*

Middle Cambrian, Kushan; Lincheng, southern Chihli, China.

Cotypes.—Geol. Surv. China No. 522.

TAITZUIA Resser and Endo, 1935

Taitzuia Resser and Endo, *in* Kobayashi, Journ. Fac. Sci. Imp. Univ. Tokyo, sect. 2, vol. 4, pt. 2, p. 90, 1935; Manchurian Sci. Mus. Bull. 1, pt. 2, p. 292, 1937.

Menocephalites Kobayashi, Journ. Fac. Sci. Imp. Univ. Tokyo, sect. 2, vol. 4, pt. 2, pp. 259, 267, 268, 1935.

When *Menocephalites* was established simply to avoid the erroneous use of *Menocephalus,* it was not observed that the species involved fall naturally into *Taitzuia. Menocephalus* Owen was founded on a trilobite fragment from Wisconsin, believed to be the anterior glabellar lobe of a *Ptychaspis* species. Walcott used *Menocephalus* in Asia only because the species have a coarsely granulose surface. Such usage is, of course, untenable, for *Menocephalus* is a nomen nudum, but without giving due consideration to the characteristics of the Chinese species, *Menocephalites* was proposed in an offhand manner.

Species referred to *Menocephalites* now become *Taitzuia.*

Taitzuia abderus (Walcott)
T. acanthus (Walcott)
T. acerius (Walcott)
T. acidalia (Walcott)
T. acis (Walcott)
T. admeta (Walcott)
T. agave (Walcott)

Taitzuia adrastia (Walcott)

Menocephalus adrastia Walcott, Proc. U. S. Nat. Mus., vol. 29, p. 61, 1905.

Levisia adrastia Walcott, Research in China, vol. 3, Carnegie Inst. Washington Publ. 54, p. 177, pl. 16, figs. 5, 5a, 1913.

Middle Cambrian, Changhia; (loc. C30) Changhia, Shantung, China.

Holotype.—U.S.N.M. No. 58084; paratype, No. 58085.

TELLERINA Ulrich and Resser

Tellerina winchelli, new species

Pleurotomaria ? advena Winchell, Amer. Journ. Sci., vol. 27, p. 228, 1864.

Ptychaspis barabuensis Winchell (part), idem, p. 230, 1864.

The specimen that Winchell described as a gastropod is the rear portion of a trilobite glabella. Comparison of casts of Winchell's specimen with the trilobites from this locality seems to indicate that it represents a species of *Tellerina.* Also a libragene referred by Winchell to *Ptychaspis barabuensis* belongs to *Tellerina* and is accordingly referred to this species. In addition, a good cranidium is contained in the Winchell types, but to what species he referred it is

not known at this writing. A good pygidium is contained in the National Museum collections.

As now constituted this species is typical of the genus in its simple brim construction, the libragenes with large ocular platforms, and the pygidium with a stout axis. It is further characterized by the anterior subdivision of the pleura expanding beyond the pleural platform to crowd out the posterior subdivision.

The cranidium assigned to the species has a large quadrangular glabella with one complete set of glabellar furrows anterior to the occipital. Another pair is indicated by short shallow furrows near the dorsal furrow. The simple brim is about as wide as the occipital ring. The fixigenes are confined largely to the palpebral lobes. There is a slight divergence of the suture anterior to the eye. The libragene assigned to the species is large throughout. The ocular platform in front is about as wide as the eye is long. A wide, heavy rim extends to the long, heavy genal spine.

A typical *Tellerina* pygidium occurs at the same locality as the cranidia and libragenes. It is characterized by a long, stout axis in which five rings are clearly demarcated. The axis is a little over half the length of the tail, and has a sharp postaxial ridge that extends nearly to the rear margin. The pleural platforms are small triangular affairs that do not reach the rear of the axis. The wide, slightly concave border is nearly smooth except that the anterior subdivision of the pleura, as it widens, remains visible nearly to the lateral margins. On the other hand, the rear pleural subdivision pinches out at the foot of the rather steep slope from the pleural platforms.

Upper Cambrian, Franconia (Devils Lake) ; (loc. 81b) near Devils Lake, Wisconsin.

Holotype.—U.S.N.M. No. 102323; paratypes, Univ. Michigan Nos. 2184, 21211 ; casts, U.S.N.M. No. 108131.

Tellerina scotlandensis, new species

Saukia stosei WALCOTT (part), Smithsonian Misc. Coll., vol. 57, No. 13, p. 384, pl. 70, figs. 12, 12a, 1914.

A pygidium referred by Walcott to *Saukia stosei* represents the genus *Tellerina*. It is characterized by the usual flaring border. The axis is well defined and extends about two-thirds the pygidial length, terminating in a pronounced postaxial ridge, which runs across more than half the border. Pleural grooves and furrows are present in average degree of development. The pygidium as a whole is rather narrow and consequently oblong in outline.

Upper Cambrian, Conococheague; (loc. 59n) quarry northwest of Scotland, Franklin County, Pennsylvania.

Holotype.—U.S.N.M. No. 59680.

TRIARTHROPSIS Ulrich, 1930

Triarthropsis blairi (Weller)

Ptychoparia blairi Weller, Geol. Surv. New Jersey Pal., vol. 3, p. 116, pl. 1, figs. 10-13, 1903.

Ptychoparia newtonensis Weller, idem, p. 117, pl. 3, fig. 10, 1903.

Acheilus ? blairi Raymond, Proc. Boston Soc. Nat. Hist., vol. 37, No. 4, p. 424, 1924.

Upper Cambrian, Kittatinny; Blairstown, and (loc. 11c) quarry near Newton, New Jersey.

Holotype.—Geol. Surv. New Jersey No. 5945; cast, U.S.N.M. No. 58929; plesiotype, Geol. Surv. New Jersey.

YABEIA Resser and Endo, 1931

Yabeia vicina (Walcott)

Agraulos vicina Walcott, Proc. U. S. Nat. Mus., vol. 30, p. 579, 1906; Research in China, vol. 3, Carnegie Inst. Washington Publ. 54, p. 160, pl. 15, fig. 8, 1913.

Megagraulos vicina Kobayashi, Journ. Fac. Sci. Imp. Univ. Tokyo, sect. 2, vol. 4, pt. 2, p. 207, 1935.

Middle Cambrian, Changhia; (loc. C70) 4 miles southwest of Tungyü, Shansi, China.

Holotype.—U.S.N.M. No. 58039.

Yabeia abrota Walcott

Agraulos abrota Walcott, Proc. U. S. Nat. Mus., vol. 29, p. 43, 1905; Research in China, vol. 3, Carnegie Inst. Washington Publ. 54, p. 156, pl. 15, fig. 3, 1913.

Metagraulos abrota Kobayashi, Journ. Fac. Sci. Imp. Univ. Tokyo, sect. 2, vol. 4, pt. 2, p. 207, 1935.

Middle Cambrian, Changhia; (loc. C23) 1 mile southeast of Changhia, Shantung, China.

Holotype.—U.S.N.M. No. 58034.

Yabeia dryas (Walcott)

Agraulos dryas Walcott, Proc. U. S. Nat. Mus., vol. 29, p. 46, 1905; Research in China, vol. 3, Carnegie Inst. Washington Publ. 54, p. 157, pl. 14, figs. 20, 20a, 1913.

Metagraulos dryas KOBAYASHI, Journ. Fac. Sci. Imp. Univ. Tokyo, sect. 2, vol. 4, pt. 2, p. 207, 1935.

Middle Cambrian, Changhia; (loc. C29) 1 mile west of Changhia, Shantung, China.

Holotype.—U.S.N.M. No. 58030.

Yabeia nana (Dames)

Anomocare nanum DAMES, Richthofen's China, vol. 4, p. 17, pl. 2, fig. 14, Berlin, 1883.

Metagraulos nanum KOBAYASHI, Journ. Geol. Soc. Japan, vol. 44, No. 524, p. 431, pl. 17, fig. 8, 1937.

Middle Cambrian, Taitzu; Taling, south of Hsiaoshih, Manchoukuo.

Holotype.—Natur. Mus. Berlin.

ZACANTHOIDES Walcott, 1888

Zacanthoides romingeri, new name

Embolimus spinosa ROMINGER, Proc. Acad. Nat. Sci. Philadelphia, p. 15, pl. 1, fig. 3, 1887.

Zacanthoides spinosus WALCOTT, Canadian Alpine Journ. vol. 1, pt. 2, pl. 4, fig. 1, 1908; GRABAU and SHIMER, North Amer. Index Foss., vol. 2, p. 273, fig. 1571, 1910.

In 1884 Walcott applied the name *spinosus* to the holotype of *Zacanthoides* from the Eureka district, Nevada. In 1887 Rominger described the Mount Stephen species as *Embolimus spinosa,* evidently without any thought of Walcott's species. When Walcott illustrated the Mount Stephen fossils in 1908, he changed the name of this species to *Z. spinosus,* but failed to notice that it is not conspecific with that at Eureka. Compared with *Z. spinosus* this species differs most conspicuously in its shorter cranidium and glabella.

Z. romingeri is characterized by a nearly rectangular glabella, which expands slightly forward. Four pairs of furrows are well developed, the rear pair slanting back almost to the transverse occipital furrow. The second pair also slants backward, but to a less degree, while the anterior pairs are directed slightly forward. The brim consists of a slightly thickened upturned rim, and the anterior furrow continues across the anterior angles. Eyes large, strongly bowed, the curvature increasing toward the rear. Heavy eye lines cross the narrow fixigenes. Fixigenes confined to large palpebral lobes, triangular anterior angles, and narrow strips at the front end of the eyes. Occipital ring expands greatly into a short but sharp-pointed spine. A node is present near each end of the ring.

Thorax has nine segments. Pleura deeply furrowed, extending into long slender spines, which have increasingly sharp angles at the fulcrum from front to back. Each axial ring carries a short spine.

Pygidium characteristic of the genus with a large, stout, highly convex axis, which extends nearly the full length of the pygidium and terminates with a short postaxial ridge. Five pairs of spines decrease in size from a very long, slender first pair to a minute fifth pair.

Middle Cambrian, Eldon; (loc. 14s) Mount Stephen, above Field, British Columbia.

Holotype.—Univ. Michigan No. 4871; plesiotypes, U.S.N.M. No. 102324.

BIBLIOGRAPHY

Bell, W. Charles.

1941. Cambrian brachiopoda from Montana. Journ. Pal., vol. 15, No. 3, pp. 193-255.

Gürich, G.

1907. Versuch einer Neueinteilung der Trilobiten. Centralbl. Min., Geol. und Pal., No. 5, pp. 129-133.

Jaekel, O.

1909. Über die Agnostiden. Deutsch. Geol. Ges. Zeitschr., vol. 61, Nos. 3, 4, pp. 380-401, 23 figs.

Kobayashi, Teiichi.

1935. The Cambro-Ordovician formations and faunas of South Chosen. Paleontology, pt. 3, Cambrian faunas of South Chosen with a special study on the Cambrian trilobite genera and families. Journ. Fac. Sci. Imp. Univ. Tokyo, sect. 2, vol. 4, pt. 2, pp. 49-344, pls. 1-24.

1939. On the Agnostids. Pt. 1. Journ. Fac. Sci. Imp. Univ. Tokyo, sect. 2, vol. 5, pt. 5, pp. 69-198.

Lorenz, Th.

1906. Geologie und Paleontologie von Ostasien. II. Pal. Teil, Deutsch. Geol. Ges. Zeitschr., vol. 58, pp. 53-108, pls. 4-6, 55 figs.

Poulsen, Christian.

1927. Cambrian, Ozarkian and Canadian faunas of northwest Greenland. Meddels. Grønland, vol. 70, pp. 235-343.

Raw, Frank.

1927. The ontogeny of trilobites, and their significance. Review *in* Amer. Journ. Sci., ser. 5, vol. 14, pp. 131-149.

1936. Mesonacidae of Comley in Shropshire, with a discussion of classification within the family. Quart. Journ. Geol. Soc. London, vol. 92, pt. 3, pp. 236-293.

1937. Systematic position of the Olenellidae (Mesonacidae). Journ. Pal., vol. 11, No. 7, pp. 575-597, October.

Swinnerton, H. H.
1915. Suggestions for a revised classification of trilobites. Geol. Mag., Decade 6, vol. 2, Nos. 617-618, pp. 487-496, 538-545, November-December.

Ulrich, E. O.
1929. The status of the classification of the trilobites. Journ. Washington Acad. Sci., vol. 19, No. 3, pp. 59-63.