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NOTES ON

PALÆOZOIC CRUSTACEÆ

NO 2.

ON THE NORTH AMERICAN SPECIES OF THE GENUS AGNOSTUS.



By A. W. Vogdes.

Alcatraz Island

(From *The American Geologist*, Vol. IV 1892.)

MINNEAPOLIS,
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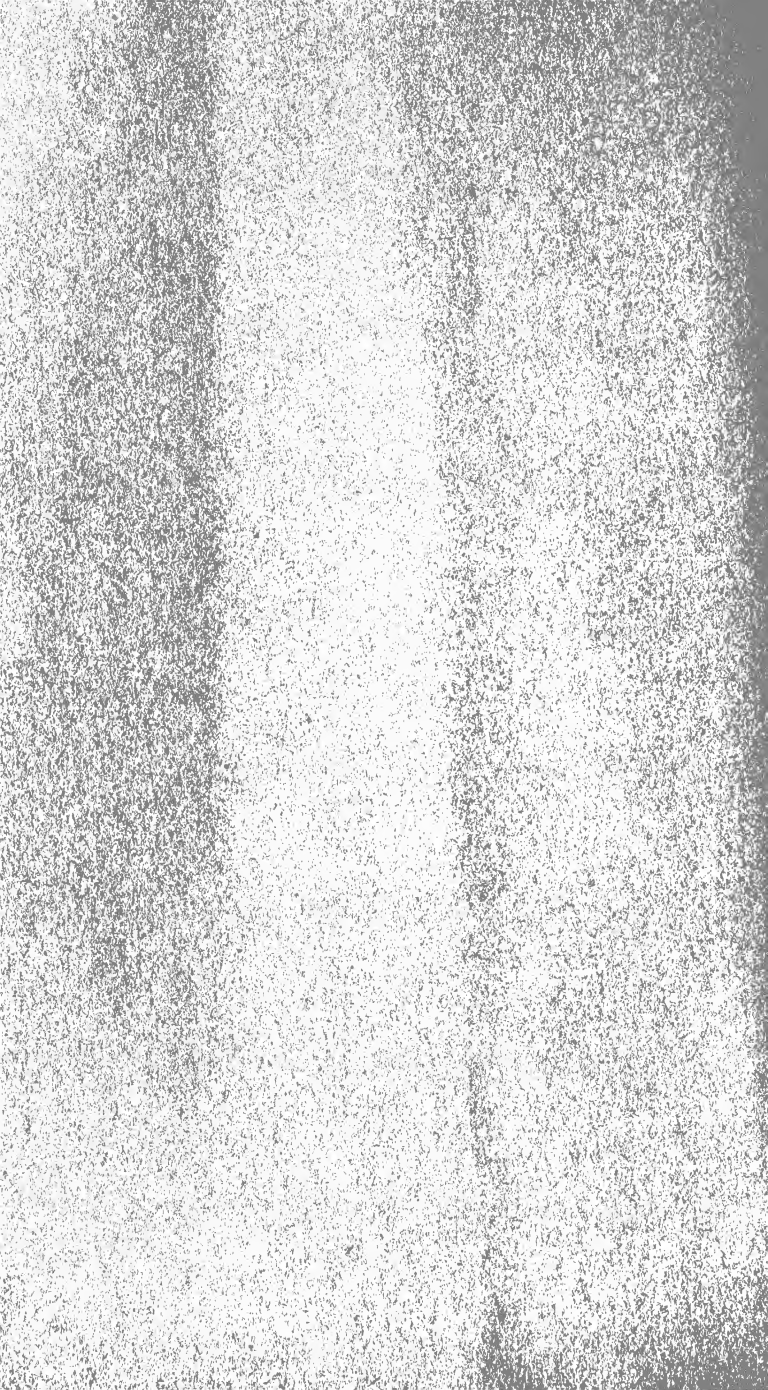


[*Notes on Paleozoic Crustacea No. 2.*]

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AGNOSTUS.

By A. W. VOGDES, Fort Canby, Wash.





[From *The American Geologist*, Vol. IX, June, 1892.]

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ON THE NORTH AMERICAN SPECIES OF THE GENUS AGNOSTUS.

By A. W. VOGDES, Fort Canby, Wash.

HISTORICAL SKETCH OF THE GENUS AGNOSTUS.

The earliest known species of this genus was described and figured by Bromell in 1729, *Lithographia Suecana*, Actis Liter., Sueciæ, Upsal, vol. 2, p. 527, under the name of *Ferniculi vagipennes*. The author mistakes the fossil for an insect and figures *Agnostus pisiformis* from the Olenus schist of Andrarum, Sweden. For a period of almost one hundred years this was the only representative of a genus, to which Brongniart gave the name of *Agnostus*, taking for its type *Agnostus pisiformis* from Linné's *Entomolithus pisiformis*, Syst. Nat. Ed. XII, p. 160.

Dalman uses the same species for the type of his new genus *Battus* in 1826, *Palaæden* p. 257.

In the year 1828, Dalman, *Vetensk. Akad. Årsber.* p. 136, described a new species from Gothland under the name of *Battus lævigatus*, and a new variety from Andrarum, as *Battus pisiformis* var. *spiniger*. The next contribution to our knowledge of this genus was made by Beyrich in 1845, *Ueber Böhm Trilobiten*, p. 44. The author adds two new species to the list from the Paradoxides zone of Bohemia, under the

*No. 1 of these notes is published in *Trans. St. Louis Acad. Sci.*, Vol. V, 1891.

names of *Battus nudus* and *B. integer*. The discovery of an entire specimen by this author removed the doubts regarding the affinities of these fossils with the order Trilobita.

The investigations made by M'Coy in 1846, Syn. Silurian Fossils of Ireland, p. 56, added the new genus *Trinodus* and one new species, *T. agnostiformis*. The non-adoption by palæontologists of *Trinodus*, and the imperfect illustration of this species have caused several identical forms to be classed under new names such as *Agnostus convexus* Salt. *A. trinodus* Salt. and *A. tardus* Salt., Brit. Pal. Foss. 1851, p. 141 (not Barrande's species). The species ranges high up in the geologic column as it approaches its extinction, in the zone with the genus *Asaphus* and *Trinuclus*.

Barrande described in his Preliminary work on the Silurian System of Bohemia, 1846, pp. 14 and 35, nine new species under this genus; which he reduces to six in his final great work on the Bohemian trilobites. Etage C with *Paradoxides bohemicus* contains—*Agnostus integer* Beyr., *A. granulatus* Barr., *A. nudus* Beyr., *A. bibullatus* Barr. and *A. rex* Barr. Etage D with *Asaphus nobilis* contains *Agnostus tardus* Barr.

Corda, Prodrum 1847, reclassifies the genus into seven new genera and 29 species. All the genera and species have been referred to well known Bohemian species and genera.

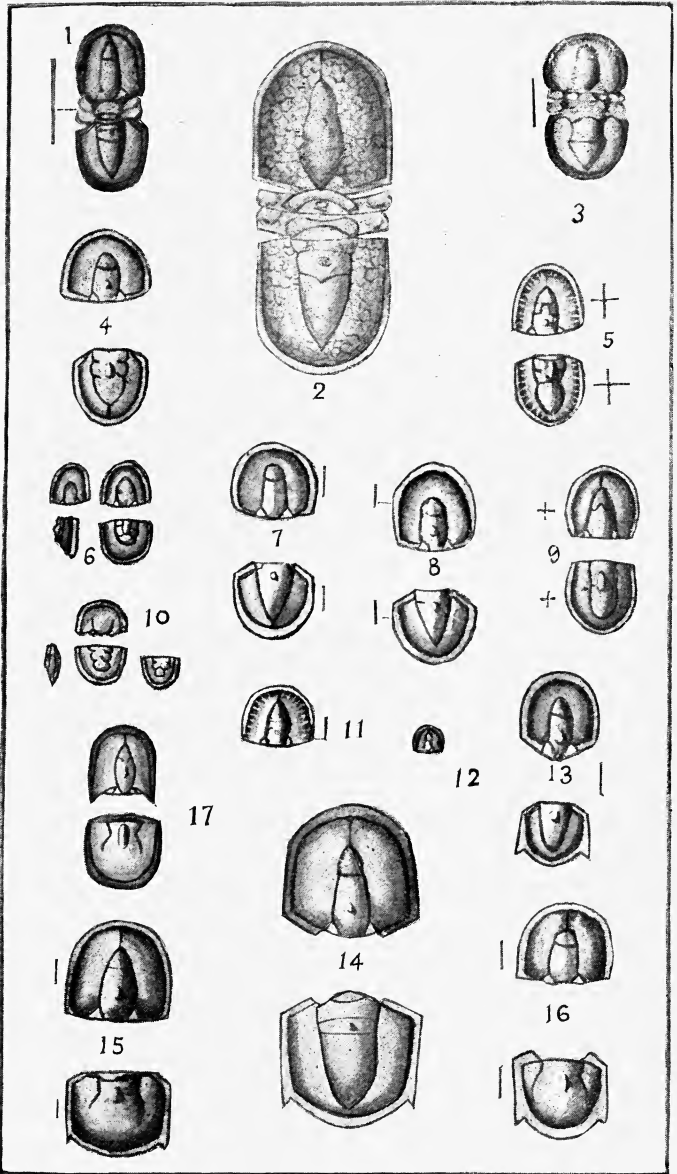
In the Mem. Geol. Survey, vol. 2, part 1, p. 351, pl. 8, Salter & Phillips reproduce under the name of *Agnostus trinodus* the Irish species which M'Coy described as *Trinodus agnostiformis*. The authors also describe a variety of this species as *convexus*.

1851—Angelin describes and figures 12 species from Sweden, Palæont. Scand., p. 5, pl. 6. Regio A (Olenus zone). *Agnostus pisiformis* Linné, *A. lævigatus* Dalm., *A. reticulatus* Ang., Regio B (Paradoxides forchhammeri zone), *Agnostus planicauda* Ang., *A. exsculptus* Ang., *A. punctuosus* Ang., *A. aculeatus* Ang., *A. brevifrons* Ang., *A. glandiformis* Ang., *A. bituberculatus* Ang., Regio C (Asaphus zone), *Agnostus lentiformis* Ang., Regio D., *Agnostus glabratus* Ang.

The first North American contribution to *Agnostus* was made by Billings in 1860, Canadian Nat., vol. 5, p. 302, in which he describes from the so-called Quebec group, three new species, *Agnostus americanus*, *A. orion* and *A. canadensis*. These species are republished in Palæozoic Fossils of Canada, vol. 1, 1865, p. 395. *Agnostus americanus* is of the type Longifrontes, congeneric with *A. trisectus* Salt. which occurs at Andrarum with *Peltura* and *Sphaerophthalmus*. *A. orion* differs from *A. pisiformis* by having the glabella proportionally shorter. The same name was used by Barrande in 1846 for a species of the genus.

1860—Eichwald, Lethæa Rossica, vol. 1, p. 1351. The author describes four species, two of which are for the first time illustrated—*Agnostus paradoxus* Eichw. and *A. nodiger*, n. sp. Eichwald refers *A. boeckii* to *A. exsculptus* Ang. The two new species are from the Asaphus zone.

1863—An important contribution to American palæontology was published during this year by James Hall; entitled Preliminary notice of the fauna of the Potsdam Sandstone, 16th Report N. Y. State Cab. Nat.



NORTH AMERICAN SPECIES OF AGNOSTUS.



Hist. The memoir describes the fossils of the Dikeløcephalus zone of Wisconsin. In this work we have illustrations and descriptions of *Agnostus josepha*, *A. parilis* and *A. disparilis*. The first species approaches *A. cyclopyge* Tull. of the Olenus zone of Sweden. The second is of the type *Lævigati* of which *A. lævigatus* Dalm. is its nearest congeneric form. Dr. Shumard described in the Am. Jour. Sci., vol. 32, 1861, p. 218, *Agnostus coloradensis* from Burnet county, Texas. This species is of the type *A. neron* H. & W.

1864—Salter in the Mem. Geol. Survey, Decade XI, describes five new species of the genus as follows: *Agnostus princeps* also vars. *ornatus* and *rudis* (Olenus zone). (This species is of the type *A. atavus*, *gibbus*, *punctuosus*, *americanus*), *Agnostus maccoyii*, Upper Llandeilo Flags, Wales, *A. limbatus*, Caradoc, *A. morea*, Lower Llandeilo, *A. trinodus*, syn. of *A. agnostiformis* McCoy, *A. trisectus*, Upper Lingula. (This species occurs at Andrarum with *Peltura* and *Spherophthalmus*).

1865—Billings in the Palæozoic Fossils of Canada, vol. 1, redescribes *A. americanus*, *A. orion* and *A. canadensis*. The author adds two new species to the list from the so-called Quebec group of Newfoundland, *Agnostus galba*, and *A. fabricus*. The former species differs but slightly from *A. tardus* Barr., Etage D, in Bohemia. The latter approaches *A. lentiformis* Ang., Regio C, of Sweden.

1866—Schmidt describes a new species in the Bull. Acad. Sci., St. Petersb., vol. 30, 1866, p. 505, fig. 45, *Agnostus cyckanovskii*.

1866—Linnarsson describes a new species in Om de Siluriska bildningarne i Mellersta Westergötland; *Agnostus affinis* from the zone with *Paradoxides tessini*.

1867—Belt in the Geol. Mag., vol. 4, p. 294, describes *Agnostus nodosus* and *A. pisiiformis* var. *obesus*, from the "Upper Cambrian" of Wales. Tullberg remarks that *A. nodosus* Belt is probably identical with *A. reticulatus* Ang. The author illustrates a broad and narrow form of *A. pisiiformis* var. *obesus*. In vol. 5, 1868, of the same magazine, the author describes *Agnostus obtusus* from the Upper Dolgelly and *A. barlowii* from the Tremadoc.

1868—Barrande describes *Agnostus bavaricus*, in Fauna Silurienne des environs de Hoff en Baviere, p. 32, figs. 46-47.

1869—Linnarsson, Om Vestergötland Camb. & Sil. aflagringar. The author describes 8 species of *Agnostus* including the following new species, *A. gibbus*, *A. parvifrons*, *A. sidenbladhi*, and *A. fallax*. The first two species occur with *Paradoxides tessini* at Andrarum. *Agnostus sidenbladhi* ranges higher up in the Ceratopyge chalk.

Sjogren in Om nagra forsteningar i Oland Kambriska lager 1871, describes *Agnostus regius* from the zone with *Paradoxides olandicus*.

1871—Hicks in the Quart. Jour. Geol. Soc., vol. 27, 1871, p. 400, describes a new species, *Agnostus cambriensis*.

1872—Meek in the sixth Report U. S. Geol. Sur. Territories, p. 664, gives the name of *Agnostus maladensis* to a species from Malade City, Utah; and that of *Agnostus bidens* to one from Gallatin City, Montana.

1872—Hicks in the Quart. Jour. Geol. Soc., vol. 28, 1872, p. 174, de-

scribes five species, illustrating a new one under the name of *Agnostus eskridgei* from near Dolgelly, Wales. This article also contains descriptions of *Agnostus davidis* Salt., *A. scutalis* Salt., *A. scaræoides* Salt. and *A. barrandei* Salt.

1872—Ford illustrates an imperfect trilobite under the name of *Agnostus nobilis* in the Amer. Jour. Sci., vol. 3, 1872, p. 421. This species is from the Olenellus zone near Troy, New York, and may prove to be a species of the genus *Microdiscus*, which occurs in the same locality.

1872—Barrande describes three new species from Etage D, in the Supplement Syst. Sil. Bohm., vol. 1, 1872: *Agnostus caducus*, *A. perrugatus* and *A. similaris*.

1876—Kayser, Beiträge zur. Geol. & Paleont. der Argentinischen Republik, p. 5. The author describes *Agnostus tilcuryensis* from the Olenus zone.

1877—White in his Preliminary Report for 1874, also in the final Report U. S. Geol. Sur., west 100th Mer., vol. 4, 1877, describes *Agnostus interstrictus* from Antelope Springs, Utah. This species is related to *A. integer* Beyr.

Hall & Whittfield in U. S. Geol. Sur. 40th Par., vol. 4, 1877, describe four new species from the Dikelocephalus zone of Nevada: *Agnostus communis*, *A. neon*, *A. prolongus*, *A. tumidosus*.

1878—Hartt, in Dawson's Acadian Geology, 2d Edition, describes *A. acadicus* and *A. similis*; the latter species is now included as a synonym of *A. acadicus*.

1878—Brögger, Om Paradoxide-skifrene ved Krekling, describes 14 species including the following new forms, *Agnostus gibbus* var. *hybrida* *A. kjerulfi*, *A. nathorsti*, *A. incertus*, *A. parvifrons* var. *mammilata*, also var. *nepos*, *A. nudus* var. *marginatus*, *A. punctuosus* var. *affinis* and *A. truncatus*. All these species occur in the Paradoxides zone.

1880—Tullberg, in his excellent monograph on the *Agnostus* species in the Cambrian formation at Andrarum, illustrates and describes 28 species of this genus with the following new species: Group Longifrons—*Agnostus fissus* Lund, MSS., *A. atavus*, *A. intermedius*, *A. elegans*, *A. lundgreni*, *A. cyclopyge*, *A. pusillus*. Group Lævigati—*A. cicer*. Group Limbati—*A. quadratus*.

Dames in Richthofin's China, vol. 4, p. 27, pl. 2, describes *Agnostus chinensis* from the Olenus zone.

1882—Holm, in Kongl. Svenska vet. Akad. Handl., vol. 6, No. 9, describes *A. torquisti*.

1884—Walcott in Paleont. Eureka Dist. describes six species including two new species: *Agnostus seclusus* and *A. richmondensis*. The first species is of the type *A. parvifrons* Linns. and the second of *A. nathorsti* Brögger.

1885—Matthew in the Trans. Roy. Soc. Canada, vol. 3, describes 10 species from the Paradoxides zone of St. John: *Agnostus regulus*, *A. partibus*, *A. vir*, also var. *concinus*, *A. acadicus* Hartt, var. *declivis*, *A. tessella*, *A. umbo*, *A. obtusilobus* and *A. acutilobus*.

1889—Walcott describes in the Proc. Natl. Mus. vol. 12, 1889, the only known American *Olenellus* zone *Agnostus*, under the name of *A. desideratus*, from Salem, New York. This species is illustrated in the 10th Report U. S. Geol. Survey, p. 630, pl. 80, fig. 5.

RECAPITULATION.*

From the <i>Olenellus</i> zone, <i>Agnostus nobilis</i> Ford, <i>A. desideratus</i> Walcott, <i>A. fallax</i> Linrs.....	3
From the <i>Paradoxides</i> zone.....	44
From the <i>Olenus</i> zone.....	6
From the <i>Dikelocephalus</i> zone.....	19
From the <i>Asaphus</i> zone.....	18
	90

AGNOSTUS, Brongniart, 1822.

Diagnosis.—The general form of the body of the *Agnosti* is elongated elliptical, the surface convex. The head presents the same structure as that part in other trilobites, with the exception of eyes and facial suture, which are wanting in this genus. The glabella determined by the dorsal grooves, never extends to the anterior contour; it is always prominent by its relief; its form varies with the species. The typical form has a glabella divided into a small frontal lobe, and a larger posterior lobe; the basal lobes forming a third part. The frontal lobe is usually subtriangular having a groove in front (*A. pisiformis*, plate ix, fig. 14). In the section *Limbati*, the glabella is broadly rounded in front, showing a great development as in *A. rex*, plate x, fig. 13. In the section *Parvifrontes*, the glabella has only a single lobe, as in *A. parvifrons*, plate x, fig. 12. In the typical glabella the posterior lobe exhibits an inclination to divide laterally, or in front, being marked by a medium ridge. The glabella is sometimes compressed on the sides by the basal lobes, but expands at this point again in its posterior projection, as in *A. gibbus*. The basal lobes are very short, so that in *A. gibbus*, they appear like a narrow band widening out on both sides of the head, forming two nodes, which are sometimes large and triangular, as in the section *Fallaces*. The basal lobes are divided in some species into two nodes on each side, as in *A. atavus*, but, they are generally very minute. The occipital groove and ring are more or less developed. The lateral lobes of the head form a concentric band with the contour; this is called by Barrande the *genal zone*. In the section *Longifrontes*, the cheeks in front of the glabella are divided by a furrow extending from the apex of the glabella to

*The varieties are omitted in this enumeration.

the limb. The surface of the genal zone is smooth in the section *Limbati*, but, in *Longifrontes* they show a tendency to striate or punctate. The limb around the head is always wider in front and narrowed towards the thorax. One can distinguish upon its surface an internal groove, and an external ridge forming the contour, sometimes the limb is extended into small points on each side, as in *A. josepha*. In the section *Lævigati* the limb becomes obsolete; in the section *Limbati* it is broad. The thorax has two segments in all the known species. The axis is usually well developed in width, whereas the pleuræ are often reduced; when the trilobation is distinct, as in *A. rex*, the thorax shows the same characteristic; when it is faint, as in *A. nudis*, the trilobation is also indistinct. The first segment is subdivided by a groove which gives to the pleuræ two bands more or less elevated, the anterior band being the larger; the second segment has the pleuræ on each side divided into bands of equal width; the points of each pleuræ are directed forward. The pygidium conforms to the head. In certain species, for example *A. bibullatus*, the pygidium is marked with dorsal grooves; but the head shows no trace of these grooves. In *A. rex* the axis of the pygidium reproduces that of the thorax. The lateral lobes form a concentric zone to the contour sometimes united, but often separated behind the axis. The limb surrounding the pygidium is sometimes extended into points. If the head has no border, that of the pygidium is augmented as in *A. nudis*. The typical axis occupies generally $\frac{2}{3}$ of the total length. In front of the axis is located a small triangular border (*genou articulaire*). The axis has three joints; the center lobe is usually the smallest, but attains the greatest height; it carries typically on the medium line a node, which sometimes is extended backwards over the third joint (*A. nathorsti* and *A. aculeatus*), also extended into a spine in *A. gibbus*. In *A. rex* the middle joint on the axis is divided by a groove, into an upper and lower lobe. The anterior joint of the axis has an inclination to become separated into three lobes; the two side lobes are common. The last joint is heart-shaped. In *A. rex* the last joint is short and rounded; in *A. cyclopyge* it is large and rounded. Sometimes the axis is long, *A. fallax*. The side lobes when the axis is short unite behind it. In the typical species they are divided by a furrow, which often becomes obsolete. In *A. kjerulfi* and *A. planicauda*

an elevated ridge extends from the spines of the pygidium to the axis.

In the section *Laevigati*, the dorsal grooves are limited on the head, only partly defining the glabella; they are also limited on the pygidium, especially in rear, as in *A. laevigatus* Dalm., plate x, fig 3. In the section *Arthrorhachis* the glabella is prominent, long and marked with small basal lobes; the axis of the pygidium is short, as in *Agnostus tardus* Barr.

PART 3. DESCRIPTION OF THE NORTH AMERICAN SPECIES.

The insignificant genus *Agnostus* surpasses in number of species all the other genera of the order *Trilobita*; in the primordial fauna we have a total number of ninety species, excluding the varieties. The species range from the *Olenellus* zone to the Lower Silurian. The zone with *Paradoxides* contains 44 species and several varieties; the *Olenus* is not so well represented; but, the genus outlived both these genera and extends into the *Ceratopyge* chalk (*A. sidendladhi*) also in the *Orthoceras* zone (*A. lentiformis* &c). The genus dies out in the zone with *Asaphus* and *Trinucleus* (*A. trinodus* &c). In North America the genus is represented by twenty-eight species which may be arranged into the following zones and sections:

OLENELLUS ZONE.

AGNOSTUS NOBILIS Ford, 1872.

This is a doubtful species and may belong to the genus *Microdiscus*.

Section I, **PARVIFRONTES**.—The glabella is only partly developed in this section (*Agnostus brevifrons* Ang., plate x, fig. 12).

AGNOSTUS DESIDERATUS Walcott, 1890.

Plate x, fig. 7. Cf. *Agnostus prolongus* Hall.

Diagnosis. Head about as broad as long, broadly rounded in front, sides curving in slightly towards the posterior margin, which slopes obliquely inwards from the postero-lateral angles to the glabella. The glabella is less than $\frac{2}{3}$ the length of the head. A narrow raised rim extends all around the margins, except across the base of the glabella, which is subcylindrical, narrow, with a small node on the posterior third of its medium line. Surface smooth. Locality, Salem, N. Y. This species is of the

type *A. parvifrons* Linrs. which appears with the genus *Paradoxides* in Norway. The pygidium of *A. prolongus* Hall, pl. x, fig. 10, has a similar form to the head of this species. The author illustrates only the head. An associated pygidium has a prominent axis bordered by a narrow convex space between it and the limb. The axis does not exhibit lateral, or transverse furrow. An elongated median tubercle is the only ornament.

PARADOXIDES ZONE.

Section II, **LONGIFRONTES**. This section is distinguished by its strongly projecting glabella and axis, which latter is generally moderately long. Crust smooth. The cheeks grooved. The crust on the cheeks and pygidium is provided with raised points. Limb generally narrow. The cheeks in front of the glabella and side lobes of the pygidium, behind the axis, divided by a groove. (*Agnostus punctuosus* Ang., pl. ix, fig. 2, also *A. pisiformis* pl. ix, fig. 14).

AGNOSTUS ACUTILOBUS Matthew, 1885. Plate ix, fig. 1.

Diagnosis.—Body elliptical, elongated. Head semi-elliptical. Dorsal furrow faint, marginal furrow and fold sharply defined. Glabella subconical, length $\frac{3}{4}$ of that of the head. The glabella is divided into two lobes; the anterior lobe is $\frac{1}{3}$ of the length and subtriangular, posterior lobe extends to the base of the head. It has an elongated ridge on the anterior half, with two faintly marked lateral furrows on the lateral edges of this lobe. The basal lobes are divided off by a sigmoid furrow and depressed below the level of the glabella. Occipital ring narrow. The cheeks are somewhat full especially in front and divided by a furrow, each cheek is seamed across by a faint furrow. Thorax of two segments; the first has five lobes, the second only three. Pygidium subelliptical. Axis is ob lanceolate, nearly $\frac{1}{2}$ as wide as the pygidium and its length is about $\frac{3}{4}$ of that of the pygidium, narrowed in the anterior third, and crossed in that part by two transverse furrows; the included lobe bears an elongated tubercle; lateral lobes of the pygidium moderately elevated and united behind the axis. Surface smooth externally, but it is granulated on the inner surface of test.

Locality. St. John group, Porter's brook, St. Martin's.

The species differs in minor points from *A. gibbus* var. *hybridus* Brögger, especially in having an elongated ridge on the front of the posterior lobe of the glabella.

AGNOSTUS OBTUSILOBUS Matthew, 1885. Plate IX, fig. 3.

Cf. *A. scaræoides* Salter, 1872, from which it differs by a narrower glabella with a more obtuse front.

Diagnosis.—The head of this species is like that of *A. acutiloba* Matthew. The pygidium described under this name is subquadrate in form, wider behind than before, and has a pair of spines at the outer angles. The axis is nearly one-half as wide as the pygidium, about four-fifths of its length and projects forward beyond the side lobes; it is obtusely lanceolate, somewhat narrowed in the middle, and divided into three lobes, of which the posterior is a $\frac{1}{2}$ longer than the length of the two anterior. The middle lobe is elevated in the middle, and bears an elongated tubercle on the axial line; there is also a faint tubercular elevation on the middle of the anterior lobe. The lateral lobes of the pygidium are somewhat narrowed in the middle of their length by the projecting sides of the axial lobe, and rapidly behind the pygidium, where they connect. The dorsal furrow is deeply impressed all around, and at the posterior angle is very close to the marginal furrow; this furrow is angled forward to the axial lobe and quadrately rounded at the posterior side of the pygidium.

Locality. St. John group, Porter's and Hanford brooks, St. Martin's.

AGNOSTUS TESSELLA Matthew, 1885. Plate IX, fig. 4.

Diagnosis.—Head semi-elliptical, higher in the middle and rear part. Dorsal furrow distinct on the posterior $\frac{2}{3}$ of the glabella, faint on the other $\frac{1}{3}$. Limb strongly elevated; the interior groove deep and strongly impressed. Glabella cylindro-conical, rounded in front, the width $\frac{1}{3}$ of that of the head; the length five-sevenths. The frontal lobe of the glabella is depressed to the level of the cheeks, and almost obsolete; the posterior lobe is cylindrical, rounded behind, bounded in front by a straight, deep furrow, and bears a small tubercle $\frac{1}{3}$ from the front. Basal lobes small. Thorax of two segments. The anterior segment bears five lobes of which the two lateral pairs are globose; the axis is transversely elongated, wider behind than before, and bears a minute tubercle at the axial line. The posterior segment is simi-

lar except the tubercle. The pygidium is semi-elliptical, somewhat wider than long, strongly elevated along the axis, truncated in front at the lateral thirds. The axis is cylindro-conical, width $\frac{1}{2}$ the pygidium, length $\frac{3}{4}$; it bears an elongated tubercle on the axial line at the anterior $\frac{1}{3}$; short furrows indent the sides of the axis, opposite the ends of this tubercle. The side lobes are narrow and divided at the extremity of the axis by a furrow, connecting the dorsal and marginal furrows.

Locality. St. John group, at Porter's brook, St. Martin's.

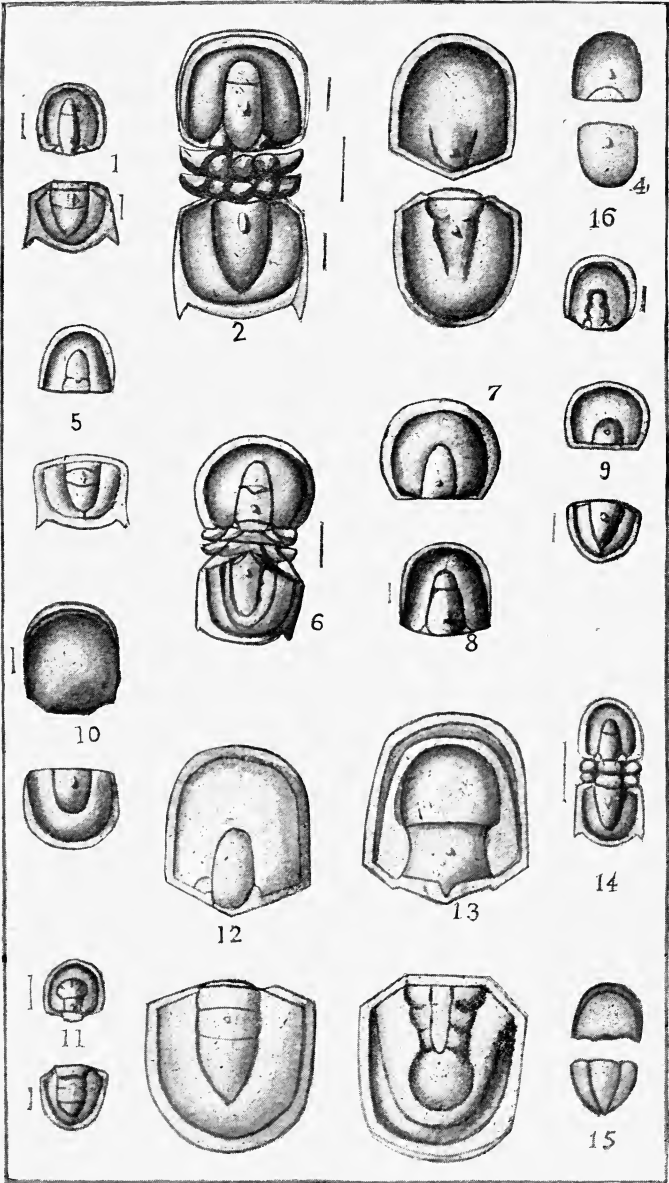
AGNOSTUS ACADICUS Hartt, 1878. Plate IX, fig. 7. Syn. *Agnostus similis* Hartt.

Diagnosis.—Head convex, depressed. Limb narrow, slightly elevated. Glabella slightly less than $\frac{2}{3}$ of the length of the head, long, elliptical, depressed convex, but more elevated than the other parts of the head; frontal lobe of the glabella, sub-circular and occupying about $\frac{1}{3}$ of the glabella; basal lobes small, but distinct. Cheeks of the same width throughout and united in front of the glabella; they are convex, more elevated along their inner margins, but sloping outwards roundly and evenly. The genal zone has a narrow, shallow, flat space or groove which follows the limb; on going posteriorly along the lateral margins it loses gradually its width towards the posterior angles of the head. Thorax unknown.

Pygidium similar to the head. The limb slightly raised, separated from the sides by a shallow but well marked groove running parallel to the margin. This groove widens at the point where it bends to go forward along the sides, in such a way as to encroach on the thin out of the limb; just before reaching the anterior margin it narrows itself from the inner side, so as to cause the side lobes to widen somewhat anteriorly. These are narrow, flattened, about $\frac{1}{2}$ as wide as the axis, narrowing to a point just behind the axis where they do not unite. The axis is about five-sixths of the length of the pygidium, lanceolated, flattened, more elevated than the side lobes of the pygidium. Dorsal furrows distinct. The axis has a small tubercle located on the median line about $\frac{1}{4}$ its length from the front margin. Surface smooth.

Locality. St. John group, Saint John, N. B.

The head of this species approaches that of *A. neon*, Hall & Whitfield.



NORTH AMERICAN SPECIES OF AGNOSTUS.



AGNOSTUS ACADICUS var. DECLIVIS Matthew, 1885. Pl. IX, fig. 8.
The author compares this species with *A. secretus* Walcott.

AGNOSTUS REGULUS Matthew, 1885. Plate x, fig. 11.

Diagnosis.—Head elongate, semi-elliptical, with straight sides, posterior contour broken by the projecting glabella, and narrow occipital ring. Dorsal furrow distinct, marginal furrow and limb sharply defined; the latter diminishes towards the posterior angles of the head. Glabella large, consisting of two lobes; the anterior lobe semi-circular, wider than the posterior lobe, elevated above the general contour of the surface and undulate with broad furrows, radiating from the back of the lobe; posterior lobe flattened, cylindrical, with a faint broad median transverse furrow interrupted at the summit of the glabella by a node, elongated on the line of the axis. The cheeks are narrowed in the middle, there being a crescent-shaped limb in front of the anterior lobe of the glabella, and an expanding cheek on each side of the posterior lobe of the glabella.

The pygidium is elliptical. The axial lobe large, high, obtusely clavate, constricted in the centre and divided into three lobes; the middle lobe is larger than the combined length of the other lobes, and has a median ridge-like tubercle. This lobe is indented in the middle of its length on each side by a short furrow; the anterior lobe is narrow and ring-like; the posterior lobe is sub-lunate. Limb distinct. The side lobes of the pygidium narrow in rear to conform with the axis.

Locality. St. John group, at Portland, Hanford and Porter's brook, St. Martin's.

This species is of the type *A. rex* Barr.

Section **PARVIFRONTES**.

AGNOSTUS UMBO Matthew, 1885. Plate x, fig. 9.

Diagnosis.—Head broadly transversely elliptical, high and contracted behind, sloping from the glabella in all directions. Marginal fold and furrow strongly marked. Dorsal grooves distinct. Glabella suborbicular, rounded in front, and behind bearing a small tubercle on the axial line, $\frac{1}{3}$ from the front. Length of the glabella $\frac{1}{2}$ that of the head. Pygidium semi-elliptical. Dorsal and marginal furrows deeply impressed; axis conical and greatly elevated above the rest of the pygidium: it bears a small tubercle $\frac{1}{3}$ from the front. The limb is rather wide at



the extremity of the pygidium, and is rounded at the anterior corners.

Locality. St. John group, at Porter's brook.

This species is of the type *A. parvifrons* Linrs.

Section III, **LIMBATI**. General form subquadrate, head has a broad limb, basal lobes large. The cheeks in front of the glabella are not divided by a central groove or grooved at the sides. The pygidium is usually produced into lateral spines. (*Agnostus rex* Barr, pl. x fig. 13).

Series A. (**REGII**). Distinguished by its broad limb, diminishing cheeks and side lobes of the pygidium. Both the anterior lobe of the glabella and the posterior lobe of the pygidium expand. (Type *Agnostus rex* Barr).

Series B. (**FALLACES**). This series has a smaller head, and moderately broad limb. Cheeks large; basal lobes rather large with a broad posterior lobe to the axis of the pygidium. (Type *Agnostus fallax* Linrs, pl. x, fig. 2).

AGNOSTUS VIR Matthew, 1885. Pl. x, fig. 14.

Diagnosis.—Head elongate, semi-elliptical, with straight sides and angulated behind. Dorsal furrow distinct. Marginal fold and groove rather flat and broad. Glabella subconical, obtuse in front, expanded behind. Length about five-sevenths of that of the head. The anterior lobe of the glabella is about two-fifths of its length; it is elliptically rounded in front, and obtusely behind; the posterior lobe is narrowed behind, and in that part is decidedly elevated above the rest of the head; a sigmoid furrow cuts off a depressed basal lobe on each side. The cheeks are moderately elevated, and of equal width all around the glabella.

The thorax consists of two segments, the first is divided into three lobes of which the outer pair is globose, the axis is elongated, transverse and indented on the front side by two strong furrows extending $\frac{1}{2}$ way across; the second segment is similar to the first, except that there are no grooves on the axis.

The pygidium is subquadrate, and armed with two lateral spines: its width one-fifth greater than its length. Axis cylindrical, obtusely pointed behind, and bears an elongated tubercle pointed backwards. The side lobes of the pygidium are about $\frac{1}{2}$ the width of the axis and narrowed towards the posterior end of the pygidium, where they connect. The marginal furrow

increases in width going backwards as far as the posterior lateral angles, where it is as wide as the lateral lobe of the pygidium, but narrows again towards the extremity of the pygidium. The limb increases in width from the front as far as the lateral spines, behind which it is constricted; at the anterior end it is angulated towards the axis, in the rear third broadly rounded.

Locality. St. John group, Portland and at Hanford brook, St. Martin's.

The species differs but slightly from *Agnostus fallax* var. *ferox* Tullb. from the Scandinavian formation at Andrarum with *Paradozides tessini*.

AGNOSTUS VIR var. *concinus* Matthew, 1885. Plate IX, fig. 13.

This variety varies but slightly from *Agnostus vir*.

DIKELOCEPHALUS ZONE.

Section LONGIFRONTES.

AGNOSTUS AMERICANUS Billings, 1860.

Syn. *Agnostus richmondensis* Walcott. Plate IX, figs. 5 and 11.

Diagnosis.—Head oblong, semi-oval, rather strongly convex, most elevated at the posterior quarter of the length, thence descending with a depressed convex slope in all directions to the sides and front. Limb very narrow. The glabella is elongate oval, width $\frac{1}{3}$ that of the whole head, length rather more than $\frac{2}{3}$ the length of the head. It has two transverse furrows which completely or partially divide it into three lobes. The anterior furrow extends all across at $\frac{1}{3}$ or a little more of the length from the front. The posterior furrow is interrupted in the middle, and is only distinctly seen on each side, penetrating $\frac{1}{3}$ the width, while its position is a little in advance of the posterior third of the length of the glabella. The space between the two inner extremities of the posterior furrows is occupied by a low conical tubercle, with the apex directed backwards. Basal lobes small and triangular. Dorsal groove distinct. Cheeks divided in front of the glabella by a furrow. The surface is ornamented by from 15 to 20 irregular, slightly impressed radiating rugose striæ. The pygidium is striated like the head. The axis has three lobes with an elongated median tubercle, extending across the anterior and middle lobes; the posterior lobe is equal in size to the other lobes.

Locality. Point Levis, Quebec.

This species approaches *A. trisetus* Salter, which occurs at Andrarum, Sweden with the genus *Peltura*.

AGNOSTUS CANADENSIS Billings, 1860. Plate IX, fig. 9.

Diagnosis.—Head obtusely oblong, semi-oval, width a little greater than the length, a concave border nearly as wide as the glabella all around. Glabella in width less than $\frac{1}{2}$ the width of the head, and in length a little more than $\frac{2}{3}$ the length of the head. Basal lobes small. The transverse furrow marking the frontal lobe of the glabella is located a little in advance of the mid-length; the tubercle is obscure and appears to be indicated by the small indentation in the middle of the transverse furrow. The cheeks are separated in front of the glabella by a furrow.

The author doubtfully figures a pygidium of this species. It has a similar form to that of the head of *A. canadensis* with the concave border all around the margin. The axis is obtusely clavate, and marked with two joints. The posterior joint is large and convex, extending quite to the concave border, where it is full half as wide as at the furrow which divides the two joints. The tubercle is situated in the transverse furrow and makes a small indentation in the edge of the posterior joint.

Locality. Point Levis, Quebec.

AGNOSTUS COMMUNIS Hall and Whitfield, 1877. Plate IX, fig. 15.

Diagnosis.—Head subparaboloid, wider than long. Surface strongly convex. Glabella nearly equaling $\frac{1}{3}$ of the width of the head; anterior third separated from the posterior lobe by a faint, transverse furrow. Central part of the glabella ornamented by an elongated and angular tubercle. Dorsal furrow distinct. Cheeks separated in front of the glabella by a groove. Basal lobes triangular. Limb flattened. Thorax unknown.

The pygidium with a flattened limb, which is ornamented with lateral spines. Surface strongly convex; in the anterior half, the dorsal furrow being directed gently inward for half their length, and then suddenly deflected outward, with a slight curvature, becoming obsolete a little behind the middle of the length. An elongated angular node marks the axis near its anterior margin. Surface of the head and pygidium smooth.

Locality. White Pine, Nevada.

This species is of the type *Agnostus cyclopyge* Tullberg.

AGNOSTUS COLORADENSIS Shumard, 1861. Plate IX, fig. 16.

The description was drawn from a single example found in Burnet county, Texas, near the mouth of Morgan's creek; the

author states that there is no fissure extending from the glabella to the anterior margin. The absence of this groove may be due to the state of preservation. This species agrees in every other respect with *A. neon*. *Agnostus neon* differs from *A. communis* in minute points, especially in the absence of the tubercle on the glabella.

AGNOSTUS ORION Billings, 1860 (cf. *A. pisiformis* Linné).

Plate IX, fig. 12.

Diagnosis.—Length and breadth about equal, sub-circular, convex, a very narrow margin all around. Glabella not quite $\frac{2}{3}$ the whole length, very convex; a transverse furrow at one-third the length from the apex; small triangular basal lobes without a median tubercle. Cheeks divided in front of the glabella by a furrow.

Locality. Point Levis, Quebec.

The same term was used by Barrande in 1846 for a species of this genus. If this species differs from *A. pisiformis* it is only in the absence of the median tubercle, which may be due to its state of preservation. There is a slight indication of the tubercle on one of my cabinet specimens from Point Levis. A pygidium from the same locality is similar to that of *Agnostus pisiformis*.

AGNOSTUS JOSEPHA Hall, 1863. Plate IX, fig. 17.

Diagnosis.—Head semi-elliptical, margined by a flattened or concave narrow limb; geual angles produced into short spines. Glabella prominent, narrow, extending about $\frac{2}{3}$ the length of the head, and crossed by a shallow furrow near the anterior end. The posterior lobe is marked by an oblique furrow on each side; a small node on the summit at the anterior termination. The triangular space on each side between the transverse and oblique furrows is like-wise elevated into a low node. The posterior central portion is gibbous. The basal lobes small and triangular in form. Cheeks divided in front of the glabella by a furrow. Pygidium of the same form as the head. Axis prominent, subquadrangle, wider than long, nearly $\frac{1}{3}$ the length of the pygidium, bearing a node or short spine on its posterior extremity; sides and body of the pygidium, outside of the axis, highly convex.

Locality. Trempealeau and elsewhere on the Mississippi about lake Pepin, Wisconsin. The species occurs with *Anomocare wisconsensis* and *Ptychaspis granulosa*.

AGNOSTUS RICHMONDENSIS Walcott, 1884. Plate IX, fig. 11.

Diagnosis.—Head moderately convex, length and breadth equal. Glabella $\frac{2}{3}$ the length and a little more than $\frac{1}{3}$ as wide at the base than the width of the head; elongate, conical in outline, strongly defined by the dorsal furrows, with the anterior third separated by a distinct transverse furrow; a little less than midway between this furrow and the posterior margin, a short furrow penetrates from each side towards the base of a minute tubercle situated on the median line. Basal lobes small, triangular. Cheeks more convex than the glabella, separated in front of the glabella by a furrow. Limb narrow. Surface ornamented by slightly irregular depressed lines that indent the surface from the margin nearly to the edge of the strong dorsal furrows. Surface smooth under an ordinary magnifying power.

Locality. Prospect mountain, Nevada.

This species is identical with *Agnostus americanus* Billings.

AGNOSTUS MALADENSIS Meek, 1873, aff. *Agnostus josepha*.

The author proposes this name for a species from Malade City, Utah, which is closely allied to *Agnostus josepha* Hall, except that the specimens do not exhibit the spines on the genal angles of the head; the author remarks "none of which are in a condition to remove all doubt on this point."

Section LIMBATI.

AGNOSTUS BIDENS Meek. Plate x, fig. 5.

Diagnosis.—Head moderately convex, slightly wider than long, bordered by a rounded margin with a strongly defined marginal groove. Glabella convex, narrow, more than $\frac{2}{3}$ the length of the head, converging anteriorly, sub-angular in front; two oblique furrows posterior to the center enter from each side, and unite just in advance of a small node, on the center of an elevation, defined behind by a transverse furrow that bends backwards; between this furrow and the occipital furrow a narrow band extends, widening out laterally, forming the basal lobes. Dorsal furrow distinct. Cheeks convex and sloping rapidly to the marginal groove from the somewhat elevated central portion. Thorax unknown. The pygidium is armed with lateral spines, and is strongly convex. Axis conical, extending more than $\frac{3}{4}$ of the entire length, ornamented with an elongated, angular tubercle on the

anterior portion, with a transverse furrow just before it, separating a narrow anterior portion; in some examples a faint transverse furrow crosses back of the tubercle. Surface of the head and pygidium finely granulose.

Locality. Gallatin City, Montana, also in the Eureka District of Nevada and elsewhere.

AGNOSTUS TUMIDOSUS Hall and Whitfield, 1877. Plate x, fig 8.

Diagnosis.—Head highly dome-shaped in outline, slightly contracted near the occipital border, very convex. Limb narrow, flattened. Dorsal furrow distinct. Glabella small, less than $\frac{2}{3}$ as long as the head, conical and very convex, especially tumid in the lower part; the central tubercle marked near its edge by a very slight line which presents the appearance of a border surrounding it. Frontal lobe about $\frac{1}{4}$ of the length of the glabella. Basal lobes triangular and minute. Thorax unknown. The highly dome-shaped outline with the form and markings of the glabella distinctly mark this species.

Locality. Eureka, Nevada. The species is of the type *A. quadratus* Tullberg.

AGNOSTUS INTERSTRICTUS White, 1874. Plate x, fig. 6.

Diagnosis.—This species of the type *A. fallax* Linns. is elliptical in form with a smooth surface. The head is broader than long. Limb narrow, forming a narrow linear depression between it and that portion of the head which it incloses. Glabella bilobed, conical, well defined by the dorsal furrows, and sharply rounded in front. A minute tubercle on the median line; near the posterior end; the frontal lobe is marked off by a shallow transverse furrow. Thorax of two joints, narrower than the head and pygidium, giving the body the appearance of being constricted at the middle. Axis broad, both its joints tumid at the ends, where they reach the dorsal furrows; lateral lobes very narrow, pleuræ about as wide as long, each pleuræ tumid and rounded at the extremities. Pygidium in form like the head. Axis a little longer than the glabella, moderately convex, with a minute tubercle on the median line near the anterior end. Sides between the marginal furrow and axis convex. The lateral angles of the pygidium are produced into sharp spines. The basal lobes of the glabella are very minute.

Locality. Antelope Springs, Utah.

Section **LÆVIGATI**. The dorsal grooves marking the glabella and axis of the thorax and pygidium, are wanting or faintly indicated. Crust smooth, sometimes with slight indications of striæ. Limb on the head disappearing; on the pygidium it becomes broad. (*Agnostus lævigatus*. Dalm., plate x, fig. 3).

AGNOSTUS DISPARILIS Hall, 1863. Plate x, fig. 15.

Diagnosis.—Head semi-elliptical, convex towards the posterior side, and abruptly sloping in front; length and breadth nearly as 3 to 4, a little concave on the posterior margin and marked near the edge by a narrow groove on each side of the middle; the centre slightly elevated close to the margin. The limb is a little wider in front than at the sides. The pygidium (?) is a little wider than long. The trilobation extends nearly to the posterior extremity, and is separated from it only by a narrow border. The axis is fully once and a half as wide as the side lobes, somewhat flattened on the summit, and very distinctly limited by the dorsal furrows. The pygidium figured with this species may be that of the genus *Microdiscus*.

Locality. Oseola Mills, on the St. Croix river, Wisconsin.

AGNOSTUS PARILIS Hall, 1863. Plate x, fig. 4.

Diagnosis.—Head semi-elliptical; length and breadth about equal, very convex in the posterior part, and curving downwards to the anterior margin. The central portion of the posterior part is limited by a faint curving groove; and anterior to its limits there is a slight elevation, which may have a node on the surface of the crust. The posterior margin, just within the angles, is produced in a minute node. The limb gradually expands from the posterior angles to the front, where it becomes well defined. The pygidium is slightly truncated at the anterior angles, the marginal rim narrower towards the articulating border. The central part is slightly more elevated and limited by furrows diverging from the anterior margin. On the median line, at a point $\frac{1}{3}$ the length from the front margin, there is a distinct elongated tubercle.

Locality. Shores of lake Pepin.

AGNOSTUS PROLONGUS Hall and Whitfield, 1877. Plate x, fig. 10.

Diagnosis.—Head elongated, or very high dome-shaped in outline. Surface depressed, convex in front and gradually rising to near the occipital border, where it becomes low, tumid. Glabella

very indistinct, of conical form, with triangular basal lobes. Limb narrow, somewhat rounded, gradually fading out along the postero-lateral angles. Pygidium (?) much like the head, but much shorter in proportion to its width. The axis occupies more than $\frac{1}{3}$ of the width, short and rounded, obconical, ornamented by a node in its upper end, and divided across by a doubly curved transverse furrow near the lower end. Dorsal furrows distinct. Limb flattened.

Locality. Eureka, Nevada.

Section **FALLACES.**

AGNOSTUS SECLUSUS Walcott, 1884. Plate x, fig. 16.

Diagnosis.—Head strongly convex, a little longer than wide, with a slight contraction posteriorly. Limb narrow with a distinct groove between it and the cheeks. Dorsal furrows well defined. Basal lobes distinct. Glabella about half the length of the head, strongly convex and squarely truncated in front; at about the anterior third a broad, short furrow penetrates on each side a short distance, and posteriorly a rounded node is separated from each lateral angle by slight furrows, forming the basal lobes. The cheeks slope rapidly towards the marginal groove, on the sides and more gradually to the front. Surface finely granulose.

Locality. Secret Canon shales, Eureka District, Nevada.

ASAPHUS ZONE.

Section IV, **ARTHRORHACHIS**, type *Agnostus tardus* Barr.

AGNOSTUS GALBA Billings, 1865. Plate IX, fig. 6.

The author describes in *The Palaeozoic Fossils of Canada*, Vol. 1, 1865, p. 291, *Agnostus galba* and *A. fabius* from Table Head and Pistolet bay, Newfoundland. Both these species are of Lower Siluric types, the first of *Agnostus tardus* Barr, and the second of *A. lentiformis* Ang. The species appear with the genera *Asaphus*, *Illænus* and *Triarthrus fischeri*, etc.

Diagnosis.—Head strongly convex. Limb narrow. Glabella convex, strongly elevated above the general surface, occupying about $\frac{2}{3}$ of the whole length of the head. Smooth, no tubercle, but with slight indentations on each side, at about the mid-length. Dorsal furrows distinct. Basal lobes triangular. Pygidium in contour and convexity, like the head. Axis strongly convex, well defined all round by the dorsal furrows; a furrow runs all across at $\frac{1}{3}$ the length from the apex; a short one on each side at $\frac{2}{3}$ the

length from the apex. The tubercle forms a longitudinal medium lobe in the anterior $\frac{2}{3}$ of the axis. The tubercle is at the anterior margin, slightly elevated above the general convexity of the axis, it is less elevated just over the anterior pair of furrows, but behind this point it rises to twice the height and terminates abruptly at the posterior furrow. The anterior lobes of the axis are distinctly separated from the tubercle by a narrow groove; the second two are not. Surface apparently smooth, but with indications of small wrinkles which unite with each other, so as to give a reticulated aspect, similar to that of *A. reticulatus* Ang. The species differs from *A. tardus* Barr, in having a shorter axis in the pygidium, and in having the node of uniform height its whole length.

AGNOSTUS FABIVS Billings, 1865. Plate IX, fig. 10.

Diagnosis.—Head semi-elliptical, uniformly and moderately convex. Limb very narrow. Glabella scarcely elevated above the general surface, not defined in front; obscurely so in the posterior half by the dorsal furrows, which are parallel, and disappear about the middle of the head. Basal lobes small, triangular. Pygidium slightly more elongated than the head. Limb narrow, flat. Axis about $\frac{1}{3}$ the whole width; it has two pairs of transverse furrows, the posterior reaching the median line, where there is a small rounded tubercle, located slightly behind the mid-length of the axis. The anterior furrows are half way between the tubercle and the front margin, their inner extremities separated by about one-third the width of the axis.

