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NEW DEVONIAN OSTRACODS FROM HUPEH

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(with 9 plates)

Introduction

The materials which form the subject of the present paper was collected from the Upper Devonian Hsiehkingssu formation of Changyang district, W. Hupeh. The majority of the ostracods are more or less ironized, and are usually well preserved.

The specimens illustrated and described in this paper comprise 15 species in 11 genera, of them 4 genera and 11 species are new.

The Hsiehkingsuu formation of Changyang district of Hupeh is estimated about 30 meters in thickness. The ostracods obtained from the thin-bedded and argillaceous limestones i.e. from the middle part of this formation are:

Primitia quadrata (sp. nov.)
Beyrichia mui (sp. nov.)
Perimarginia tuberosa (gen. et sp. nov.)
Perimarginia ovata (gen. et sp. nov.)
Cavellina hupehensis (sp. nov.)
Cavellina lativata (sp. nov.)
Cavellina sinensis (sp. nov.)
Knoxiella? sp. (sp. nov.)
Hupehella lunata (gen. et sp. nov.)
Trinota costata (gen. et sp. nov.)
Bernix? sp.
Mennerites hupehensis (sp. nov.)
Gen. et sp. A (indet.)
Gen. et sp. B (indet.)

In association with the above forms, many specimens of *Yunnanella abrupta* Grabau, *Yunnanellina triplicata* Grabau, *Tenticospirifer supervilis* Tien, etc. have been found. The ostracods of the iron-oolitic bed, i.e. from the lower part

of the formation are characterized by the following forms:

Beyrichia mui (sp. nov.)
Mennerella? sp. (sp. nov.)
Mennerites hupehensis (sp. nov.)
Perijonesina sinensis (gen. et sp. nov.)
Cavellina hupehensis (sp. nov.)
Cavellina latiovata (sp. nov.)
Cavellina sinensis (sp. nov.)
Knoxiella? sp. (sp. nov.)
Bairdia sp.
Hupehella lunata (gen. et sp. nov.)
Bernix? sp.
Gen. et sp. B (indet.)

These species have been found in association with *Yunnanella abrupta* Grabau, *Y. abrupta scunurioides* Tien, *Tenticospirifer* sp.. All the fossils belong to the Upper Devonian.

On examining the vertical distributions of different species of ostracods, the writer noticed that *Trinota*, *Perimarginia* and *Primitia quadrata* are confined to the middle part i.e. the yellowish argillaceous limestones of the Hsiehkingssu formation, while the genera *Perijonesina* and *Mennerella* are restricted to the lower part i.e. the iron bearing rocks of this formation. The species *Beyrichia mui* and *Cavellina latiovata* have been found abundantly in the yellowish argillaceous limestone but rather rarely in the iron-bearing rocks; and the species *Cavellina hupehensis* and *Cavellina sinensis* are rich in the lower part and few in the middle. As a whole, the ostracods of the Hsiehkingssu formation of this area are varied in form and abundant in amount, they exhibit complex and distinquished structures and differents ornament which are favor to critical identifications.

Ostracods are not yet known in the corresponding strata of other areas in China. Some ostracod genera such as *Mennerites*, *Mennerella?*, *Knoxiella?*, are now known in "Свенордские слои" of Upper Devonian (Frasnian) of Russian platform. The species described in the present paper as *M. hupehensis* and *Knoxiella* sp. are clearly related to *Mennerites svinordensis* Egorov and *Knoxiella variabillis* (Gleb. et Zasp. in litt.) etc. Other species such as *Cavellina latiovata* and *C. hupehensis* recall the *Cavellina uchtensis* Egorov and *C. devoniana* Egorov of "Пестроцветная толца" of Upper Devonian of Russian platform. The ostracods

of the Hsienkingssu formation bear indeed a remarkable affinity to those of the Upper Devonian in "Главное девонское поле" of Russian platform.

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Descriptions of species

Superfamily Beyrichiacea

Family Primitiidae Ulrich & Bassler 1923

Subfamily Primitiinae Ulrich and Bassler 1923

Genus *Primitia* Jones & Holl 1865

Primitia quadrata Hou (sp. nov.)

(Pl. 1, figs. 10-12, 14-17)

Description: Carapace small in size, elongately truncato-ovate in lateral view, hinge line straight and shorter than the length. Dorsally elongate subovate; dorsum straight, venter slightly convex. Ends round, with the anterior end higher than the posterior, forming the greatest height of valve, the maximum thickness at the posterior portion. Antero-dorsal angle larger than postero-dorsal angle, the postero-ventral angle larger than antero-ventral one.

Surface rather regularly convex, marked by the fine reticulations, with a small, deep vertical median sulcus or furrow from center to dorsal, and an indistinct node in the front of median furrow. Right valve slightly larger than the left overlapping the later along the free margins; margin of left valve depressed, and is coincident with the margin of right valve; both valves are similarly equal to each other in ventral view.

Horizon and Localities: from the thin-bedded argillaceous limestone of Upper Devonian, Hsiehkingssu formation, Changyang district of Hupeh. Loc. N. (By 7, By 230).

Holotype: Cat. N. (7484).

Family Beyrichiidae Jones 1894
Subfamily Beyrichiinae Jones 1894
Genus *Beyrichia* McCoy 1844
Beyrichia mui Hou (sp. nov.)
(Pl. 1, Figs. 21-25)

Description: Carapace subsemicircular, widening posteriorly. Hinge long and straight, forming the greatest length of the valve. Anterior cardinal angle less than the posterior angle, which is near equal to 90 degrees. Ventral margin gently sloping down the anterior end, and abruptly bending to the other end.

Carapace smooth, divided by two deep, united sulci, into three expanded lobes. First (anterior) lobe more flat and thick, broad at the upper part, strongly convex at the ventral, curving backwards along the anterior edge, with a vertical depression in the antero-dorsal part of the lobe. Second (median) lobe isolated, small, oval, very strongly convex, situated in the center. Third (posterior) lobe more longer, narrower than the first, curving forwards and over-reaching the middle of the ventral margin. In some specimens the third lobe has a low and flat convexity but in the other ones it is strongly convex. In the inner side, these lobes (first and third) are sharply defined by the deep sulcus, and on the outer side of the third lobe these lobes slope rapidly to the level of the valve margin and the first lobe slopes gently to the edge at the upper part, and rapidly at the ventral. All lobes are separated by deep, and narrow sulci, joined below by a funnel-shaped connection near the ventral margin. Surface smooth, ornamented by four short and rounded spines, nearly equal in size; two of them occur in the dorsal part near extremities, pointed antero- and postero-dorsally; the outer two spines situated in the lower end of the first and third lobes. A small indistinct tubercle occurred in the lower part of inner side of the anterior lobe. Hingement unknown.

Relationships: With regard to the carapace and external structure of the shells, this species agrees in some respects with *Beyrichia moodeyi* Ulrich and Bassler and *Beyrichia salterina* Jones, but differs from the latter in the presence of the spines and in the absence of the striated marginal border. The shorter and broader anterior lobes of our species differ markedly from *Beyrichia salteriana* Jones.

Horizon and Localities: Common in the oolitic-hematitic limestone and rare in the thin-bedded limestone the Upper Devonian, Hsiehkingssu formation of the Changyang district, Hupeh. Loc. N. (By 7, 230, 218).

Holotype: Cat. N. (7489).

Family Kloedenellidae Ulrich & Bassler 1908

Subfamily Kloedenellinae Egorov 1950

Genus *Mennerella* Egorov 1950

Mennerella? sp. nov.

(Pl. 1, Figs. 26-30)

Description: Lateral view of carapace ovoid shape, with a considerable broad anterior. Maximum height in front of the middle. Dorsal margin and hinge line near straight or slightly convex, the length of the hinge line is about two-thirds the length of valve. Ventral margin nearly parallel to the dorsal, both ends rounded. Dorsal and ventral angles obtusely rounded.

Two sulci running on the surface of the valve, the anterior one situated in the front of the middle dorsal and the posterior one lying behind the middle of dorsal, the former is the smaller and shorter, the length of the latter is a little less than one-half the height of valve, a pit of just falling into the base of the latter sulcus and between the two sulci is a bean-shaped node. There are many irregular lines surround the sulci and node forming the reticulated structure on the surface.

The present material consists of a number of left valves and an internal mould of right valve; a depression has been recognized around the free margin of left valve (except in the dorsal margin), it indicates possibly that the right valve overlaps the left one or directly in contact with the latter.

Relationships: The present form is referable to the genus *Mennerella* Egorov in its general features of the surface sculpture clearly similar to *M. tuberosa* the genotype of that genus, but our specimens are poorly preserved and no complete hingeline can be readily recognized.

Horizon and Locality: Oolitic-hematitic limestone of Upper Devonian, Hsiehkingssu formation of the Changyang district of Hupeh. Loc. No. (By 218).

Holotype: Cat. N. (7492).

Subfamily Perprimitiinae Egorov 1950

Genus *Mennerites* Egorov 1950

Mennerites hupehensis Hou (sp. nov.)

(Pl. 8, Figs. 1-15)

Description: Carapace elongated ovate in side view, truncated dorsally by

straight hinge line about two-thirds of greatest length of the valve; cardinal angles obtuse, the anterior cardinal angle larger than the posterior and the postero-ventral angle larger than antero-ventral one.

Ventral margin straight or slightly convex, ends rounded; the anterior end higher than posterior end. Surface moderately convex, ornamented by two nodes and a ventral rib parallel to the ventral margin. The nodes are separated by a broad median sulcus or depression. The anterior node is always lower than the posterior one.

A great number of internal moulds are present, the surface marking of the moulds is inconspicuous and seems to be ornamented by delicate reticulations. Hingement unknown.

The female form of this species differs from the male in the swelled posterior end and in the presence of a narrow furrow or depression in front of the posterior end, the nodes and ventral rib indistinct. The maximum thickness of the female form is at the swelled portion of posterior end, but that of the male is at the ventral or at posterior node. The sexual differences in the young forms is indistinguishable in regarding to their morphological characters.

Relationships: In regard to the shape of carapace and the characters of nodes and rib, this species resembles closely *M. svinordensis* Egorov from the Upper Devonian of Leningrad and Karlning regions of Russian platform. It differs therefrom in the relatively greater height of the anterior end, the nearly straight or slightly convex ventral margin and a pronounced depression or furrow in the front of the swelling portion of the female individual.

Horizon and Locality: Common in the oolitic-hematitic limestone bed and rare in the thin-bedded limestone, Upper Devonian, Hsiehkingssu formation, Changyang district of Hupeh. Loc. No. (By 218, 230, 7).

Holotype: Cat. N. (7655).

Subfamily Cavellininae Egorov 1950

Genus *Perimarginia* Hou (gen. nov.)

Genotype: *Perimarginia tuberosa* Hou (gen. et sp. nov.)

Diagnosis: Carapace median in size, elliptical or oval in lateral view, the large right valve overlapping the left all round the free margins. Surface of valves furrowed by a deep, long and inclined forward median sulcus; dorsal margin of the

right valve abruptly swollen just at the upper part of median sulcus, and with a groove within the dorsal border into which the simple edge of the left valve is received. Postero-dorsal margin nearly straight and sloped backward. Dorsal margin of the left valve nearly straight, ventral margin broad round, with the maximum overlap at the ventral and posterior margins.

Shell consists of a thick outer and a thin inner layers, both layers combined together at the dorsal and ventral portions but the space between the layers is rather wide at anterior and posterior portions.

Carapace of female wide and short in the mature stage, with the greatest thickness at the middle of posterior to the end, swelling bend sloping abruptly downward. Carapace of male elongated oval, ends near equal, dorsal and ventral nearly parallel to each other or slightly convex; median sulcus more or less narrow, maximum thickness at center or slightly to the posterior portion.

Surface ornamented by a number of tubercles, arranged uniformly throughout.

Relationships: The general features of the new genus *Perimarginia* are similar to those of genus *Marginia* Polenova 1952 from the Devonian of Russian platform and the genera of the family Kloedenellidae. The genus *Perimarginia* has a characteristic overlap conspicuously from the ventral to the posterior of free margin, whereas in *Marginia* the maximum overlap is at the antero- and postero-ends of the dorsal margin. The chief characteristic of the valve of the genus *Perimarginia* consists of the outer and inner layers, this characteristic is unknown in the genus *Marginia*.

Geological range: Upper Devonian, Hupeh Province.

Perimarginia tuberosa Hou (sp. nov.)

(Pl. 2, Figs. 1-24; Pl. 3, figs. 1, 4-8, 9-11)

Description: Specimens consist of numerous male, female and immature forms. General outline sub-elliptical to elliptical in side view, wedge-shaped in dorsal view, maximum length lying in the mid-way between dorsal and ventral margins. Maximum height just conjunct line from the convex portion or dorsal margin to ventral. maximum breadth in the posterior of valve.

Dorsal margin convex, sloping from the sulcus toward the posterior end, to form a slightly accuminated posterior end. Ventral margin regular round, strongly incurved. Valvular overlap not very apparent; right valve, however, having a

simple and incurved from margin which fits into the depression similarly placed on the left valve but the greatest overlap at ventral of both valves.

Surface ornamented by a number of tubercles ranged irregularly and distinct on the anterior half portion, indistinct or absent on the posterior half. A large, long sulcus curved backward at its base, situated in the middle of the valve, a small node-like swelling on the side before the sulcus.

Carapace of the female form short and wide, the greatest thickness at the middle of posterior to the posterior end and the maximum thickness at middle or near the middle of the valve. Carapace of the male long and narrow, elongate oval in side view; dorsal and ventral margins slightly convex; ends round about equal in height, or the anterior and more or less narrower than the posterior. Dorsal and ventral angles broadly rounded, more or less equal. The right valve overlaps the left along the free margins, a depressed border is present along the margin of left, but absent on the dorsal margin. The maximum length is about the middle from dorsal to ventral, the maximum height is at about the middle from anterior to posterior end, and the greatest thickness is at the position from the middle of valve to posterior portion.

In the immature form the sulcus is especially large and deep; in the female the postero-dorsal margin is straight and decline backward clearly, ventral margin near straight. The young stage is characterized by the right overlap the left along the free margins especially at the ventral, the margin over stretch the hinge line, which is straight and declined backward. A pit-shaped depression is inconspicuous.

The valve are divided into two layers in the anterior and posterior ends. The outer layer is thicker than the inner one.

Relationships: This species is related to *Perijonesina sinensis*, it can be easily distinguished from the latter by the large, deep, long and declined forward middle sulcus, by the dorsal margin which is convex just on the top of the sulcus, by the straight and slope backward postero-dorsal, and by the presence of the tubercles on the surface, the distribution of these tubercles is restricted only to the anterior portion of valve.

Horizon and Localities: From the argillaceous yellowish thin bedded limestone of Hsiehkingssu formation, Upper Devonian, Changyang district of Hupeh. Loc. No. (By 7),

Holotype: Cat. N. (7518).

Perimarginia ovata Hou (sp. nov.)

(Pl. 3, Figs. 2-3, 12-20; Pl. 4, figs. 1-10)

Description: Carapace median size, outline elliptical in lateral view, truncated dorsally by straight hinge, length of hinge of the mature forms about one-half the greatest length; anterior cardinal angle of adult round and more larger than the posterior cardinal angle; antero- and postero-ventral angles inconspicuous. Both ends nearly equal in the immature stages but the posterior margin is more narrowly rounded than the anterior margin in the adult forms. Dorsal margin nearly straight or slightly convex curving unequally towards both ends. Ventral margin strongly convex curving subequally towards both ends.

The right valve overlaps the left along the free margins, the greatest overlap at the ventral; there is a groove on the margin of left. Owing to the state of the preservation a great number of individuals are internal mould, the ridge structure is invisible in the right valve.

Commissure line is not on same plane, forming a curved line at the ventral. Surface marked by a number of tubercles similar to the surface ornamentation of the type species of the genus, these tubercles arranged irregularly in order. The median sulcus is narrow, long and subvertical, lying just at the mid-length or slightly toward the anterior, and extending over or nearly halfway from dorsal to ventral margin. A pit falls into the ventral extremity of the sulcus, on each side of the sulcus is an indistinct node. The maximum length and height lies at about the midline from dorsal to ventral and from the anterior to posterior end. The greatest thickness lies at the ventral portion of the carapace.

In immature and young forms, the dorsal margin is straight at the part about equal to one-half the length of valve. Ends nearly equal. Surface moderately convex. Median sulcus distinct.

Relationships: As compared to *P. tuberosa*, *P. ovata* is a shorter and rounded species. The median sulcus of *P. ovata* is narrow and nearly vertical, the ventral margin is curved more or less arc-shaped and overlaps along all the free margins.

Horizon and Locality: It was obtained from the argillaceous yellowish limestone of Hsiehkingssu formation, Upper Devonian, Changyang district, Hupeh. Loc. No. (By 7).

Holotype: Cat. N. (7544).

Genus *Perijonesina* Hou (gen. nov.)

Genotype: *Perijonesina sinensis* (gen. et sp. nov.)

Diagnosis: Carapace truncated, elliptical in lateral view, hinge line straight; anterior cardinal angle well-defined, obtuse, and posterior cardinal angle broadly rounded. Dorsal margin nearly straight and ventral margin gently convex; ends rounded. A sharp, narrow median sulcus originating at the center extends from center to dorsal; it is nearly straight, sometimes an inconspicuous depression is situated in front of the median sulcus. Small pit present just below the median sulcus. The larger right valve overlaps the left along the dorsal and ventral margins; anterior of right valve with a thick flange besides the depressed margins.

The shell is divided into two layers, the outer is thicker than the inner, both layers are separated one from the other from anterior to posterior and united at dorsal and ventral margins. The median sulcus and pit are covered by the inner layer and forming a smooth in reversed surface.

The females are associated with males and young forms, with the females always more abundant than the others. The maximum thickness of the female is at the posterior portion, and the maximum thickness of the male is at the middle or slightly to the posterior. Surface smooth or ornamented by reticulations.

Relationships: This new genus is similar to the Carboniferous genus *Jonesina* Ulrich et Bassler, emend. Egorov and the Devonian genus *Knoxiella* Egorov. It differs from the former in having overlap only in the dorsal and ventral margins, the dorsal cardinal angles are unqual with more angulated outline antero-dorsally. Nodes inconspicuous, sulcus short and flattened, smooth in reverse surface. It differs from the latter in having the thick flange at the outer part of depressed border; the ventral margin of the larger right valve curves outward distinctly and overlap the left only at the dorsal and the center of the venter.

Geological range: Upper Devonian, Hupeh Province.

Perijonesina sinensis Hou (sp. nov.)

(Pl. 4, figs. 11-19; Pl. 5, figs. 1-29; Pl. 6, figs. 1-6)

Description: Carapace in lateral view bean-shaped or elliptic. Outline formed by higher right valve. Dorsal margin nearly straight, it produces a projection in the anterior end of the dorsal margin, and curves smoothly into the anterior

margin. The middle of the ventral margin is moderately convex, and curved regularly into both ends; the posterior and anterior margins are rounded, curving into the dorsal margin.

The carapace of dorsal view is wedge-shaped in female individuals and fusiform in male. In females the anterior end is narrowly pointed and the posterior end is bluntly rounded, the maximum thickness at the posterior; the greatest thinkness of the male at the middle.

The free margin of the valve is depressed forming a furrow, which begins from one-fourth of the anterior to posterior and around the valve to the posterior end of dorsal margin, but it is indistinct in the dorsal margin. The right valve is higher than the left, and overlaps it slightly in the dorsal and more strongly in the middle of the ventral margin. In young forms the end margins of one valve are directly in contact with the other valve and no overlap.

The surface of the carapace is smooth, ornamented with a median sulcus the length of which is about one-half of the valve height. A pit is situated in the lower part of the sulcus; before the sulcus is a node and short depression.

The shells in a number of specimens are divided into two layers especially in the mid-line from anterior to posterior. The inner layer is separated by a distance from the outer layer in both ends but it is united in the dorsal and ventral margins. The median sulcus and pit are covered by the inner layer in reverse direction.

The young forms of this species occur with the mature forms. The median sulcus distinct and forming a shallow linear depression; the posterior is developed and its outline of dorsal view is wedge-shaped. The right valve overlaps the left conspicuously in the middle of ventral margin, and no overlap at the ends. These characters are indistinct in the early stage of young forms.

Relationships: This species is characterized by its shape somewhat reminiscent of the *C. hupehensis* from the same bed. It differs from the latter in having the anterior depression lying before the median sulcus, a great convexity in the anterior end of dorsal margin and no overlap at the posterior end.

Horizon and Localities: This species occurs abundantly together with *C. hupehensis*, *C. sinensis*, *Beyrichia mui* etc., they were obtained from the oolitic-hematitic limestone bed of Hsiehkingssu formation, Upper Devonian, Changyang district of Hupeh. Loc. No. (By 218).

Holotype: Cat. N. (7578).

Genus *Cavellina* Coryell 1928 emend. Kellett 1935

Cavellina hupehensis Hou (sp. nov.)

(Pl. 6, figs. 7-25)

Description: Carapace elongated sub-elliptical; dorsal margin of the right valve slightly convex or nearly straight; ventral margin more convex in the middle forming the greatest overlap on the left valve. Both dorsal and ventral margins of left valve are nearly parallel to each other, marginal furrow or marginal depression present besides the free margins of left valve except the hinge margin. Ends rounded with the anterior more narrower than posterior. Right valve a little large and more wider than the left; the larger valve overlaps the small conspicuously on the ventral middle, slightly on the dorsal and setting down on the posterior marginal depression and is contact direct at the anterior portion at about one-fourth of the valve length by the anterior marginal depressional zone of both valve; that is there is no overlap at the anterior.

Surface smooth or marked by reticulations. The ornament is not clearly shown owing to the state of preservation. The greatest height and length are at the median line. A wide, shallow median sulcus is clearly visible at the middle dorsal; a distinct pit falling in the sulcus.

Carapace of the females in dorsal view is wedge-shaped. Maximum thickness is clearly in the posterior. The outline of males is narrow and fusiform with the maximum thickness approximately at the middle of the length.

Young forms are abundant in our material. Many of them have the appearance of females, swelling posteriorly; median sulcus and pit indistinct.

Relationships: This species can be easily distinguished from *Cavellina devoniana* Egorov by the broad shallow sulcus, instead of the smooth surface, and the flange margin is present in the latter species.

Horizon and Localities: It was collected from the oolitic-hematitic limestone of Hsiehkingssu formation, Upper Devonian, Changyang district of Hupeh. Loc. N. (By 218).

Holotype: Cat. N. (7592).

Cavellina latiovata Hou (sp. nov.)

(Pl. 9, figs. 1-8)

Description: Carapace moderately sized, subtriangular to broad ovate, dorsal

and ventral margins slightly convex or nearly straight, it is depressed at about the middle of dorsal margin. Posterior end more rounded than anterior. Both cardinal angles obtuse, compressed anteriorly; posterior expanded and swollen. The greatest height and thickness are just in the middle of posterior; the maximum length is the distance of posterior to anterior apex. Surface smooth and marked by a sub-median depression, which begins from the dorsal to the middle of valves. It is cuneiform in the ventral or dorsal view. The sub-median depression of female specimens are more clearly shown than that of the male, and is comparatively clear at the central than at its two ends. It forms a faint ridge on each side of the depression. The ends of female are nearly equal, the greatest thickness of the valves are at the posterior part near the margin; but in male specimens, the maximum height and thickness are at the middle part of the posterior. The end margins are quite regularly curved forming the expanded, rounded posterior end and narrow anterior. Surface of male decorated by a faint depression, which is situated anteriorly at about one-third of the valve length.

Relationships: This species can be distinguished from the Upper Devonian species *Cavellina uchtensis* of Russian platform by the large size, the smooth surface, and the nearly symmetrical dorsal and ventral margins. The short and very shallow depression in the antero-dorsal portion is also a characteristic feature of this species.

Horizon and Locality: Hsiehkingssu formation of Upper Devonian, localities By 230 and By 7 common; locality By 218 rare.

Holotype: Cat. N. (7611).

Cavellina sinensis Hou (sp. nov.)

(Pl. 7, figs. 2-8, 16-27)

Description: Carapace elliptical or ovate in lateral view, a V-shaped median sulcus conspicuous, commissure line curved. In dorsal view, the carapace is nearly wedge-shaped in mature specimen of female, sub-fusiform in the young and masculine individuals; dorsal margin more convex and ventral margin nearly straight or slightly convex, anterior end a little more blunter than the posterior, greatest thickness below the middle and behind the median sulcus. The larger right valve overlaps the left along the free margins, which is strong at the ventral and dorsal margins, the anterior and posterior margins of right valve seem to overlap slightly upon the left one, but the details are not clear in the material studied.

Surface of valves smooth; moderately convex, a V-shaped sulcus is situated slightly behind the middle of the valve; the length of the sulcus is from one-half to two-thirds the height of shell; the position of muscular scar seems to be fallen at the base of the V-shaped sulcus. The male and female specimens have two depressions, one in front of, and the other behind the median sulcus, i. g. at the antero- and postero-ventral portions; the latter depression is clearly present on the external surface of female valves which are perhaps corresponding to the position of the partition in the interior of the valve; the greatest thickness of female individual is at the posterior part. There is a shallow postero-ventral depression in the male and its maximum thickness is at the one-third part of the valve from posterior to anterior.

Relationships: The external characters of this form is related to Lower Permian species *C. Maanshanensis*. It differs from that form in having more high and slightly convex valves and a V-shaped distinct sulcus. The muscular scar falls at the base of the V-shaped sulcus. The commissure line is curved at the dorsal.

Horizon and Localities: From Hsiehkingssu formation of Upper Devonian, Changyang district of Hupeh. Loc. N. (By 7, 218).

Holotype: Cat. N. (7649).

Subfamily Lichiminae Posner (in litt.)

Genus *Knoxiella* Egorov 1950

Knoxiella? sp. nov.

(Pl. 7, figs. 1, 9-15)

Description: Carapace moderately sized, subovate in outline; hinge line and dorsal margin nearly straight but declined backward, or slightly convex; posterior outline much more uniformly rounded; anterior outline broadly rounded antero-ventrally, becoming more angular antero-dorsally at about right angle. Convex venter meets the anterior and posterior outlines with unequally rounded curvatures; the hinge line is sub-parallel to the venter, the antero-dorsal margin is nearly parallel to the postero-ventral. Surface smooth, strongly convex, the maximum thickness at the middle of ventral to posterior portion; the maximum length is near the midline from dorsal to ventral. A faint short depression is situated at the anterior portion and extends to the dorsal margin. Overlap and hingement unknown.

Many young forms are present in the material, they belong possibly to this

species. The young forms are oval in lateral view, with a small distinct pit at or near the dorsal of anterior portion; ends rounded, anterior end more narrower and thicker than the other end. The commissure line at about the same plane.

Relationships: This species resembles the Upper Devonian species *Knoxiella variabillis* (Gleb. et Zasp., in litt.) in external characters, but differs from it in having only one sulcus near the antero-dorsal portion; the antero-dorsal angle is about 90 degrees and angulated, the postero-dorsal angle is rounded.

Horizon and Localities: From Hsiehkingssu formation of Upper Devonian, Changyang district of Hupeh. Loc. N. (By 7, By 218).

Syntypes: Cat. N. (7627, 7631).

Superfamily Cypridacea

Family Bairdiidae Sars 1887

Genus *Bairdia* McCoy 1844

Bairdia sp.

(Pl. 9, figs. 9-10).

Description: Carapace small in size, dorsum rounded, venter almost straight or slightly incurved; antero-dorsal nearly straight and slopes to the end; postero-dorsal gently curved and longer than antero-dorsal. The left valve overlaps the right around the entire margin, including the hinge; posterior projection long and low, the greatest height lies before the center. The specimen is an internal mould, other character unknown.

Horizon and Locality: From Hsiehkingssu formation of Upper Devonian, Changyang district of Hupeh. Loc. N. (By 218).

Holotype: Cat. N. (7618).

Family incertae

Genus *Hupehella* Hou (gen. nov.)

Genotype: *Hupehella lunata* Hou (gen. et sp. nov.)

Diagnosis: Carapace small to moderate size, thick, subovate in outline, hinge straight or inclined toward the anterior; cardinal angles obtuse and well defined. Globose swelling in dorsal margin above the hinge line. Ends narrow, rounded, ventral swollen; broad flange along free margin extending to mid-height of each end, more or less concave at the ventral. Distinct sockets on the extremities of hinge line of left valve and a slit-like furrow between the sockets; no structures

are observed in the right valve. Surface of valve smooth or reticulated.

Geological range: Upper Devonian, Hupeh Province.

Hupehella lunata Hou (sp. nov.)

(Pl. 8, figs. 16-21)

Description: Carapace of the large size, subtriangular to subovate in lateral view, moderately convex; hinge straight or declined toward the anterior, dorsal margin strongly convex far above the hinge line, ventral margin bending broadly upward to both ends. Both ends rounded but narrow; dorsal and ventral portions swollen, more or less convex than the middle of the shell. A broad, thick flange along the free margin extending to mid-height of each end, more or less concave at the venter. Socket distinct, sub-rounded on the extremities of hinge line of the left valve, forming a slit-like furrow between the two sockets; right valve ill-preserved, with a broad indistinct flange.

Surface not marked by sulcus and pit, but with uneven convexity, the convexity of the dorsal and ventral portions are more conspicuous in the young forms than in the mature.

The length of large form is 1.35 mm, height is 0.9 mm; the small length is about 0.6 mm, height is 0.45 mm.

Horizon and Localities: From the Hsiehkingssu formation of Upper Devonian, Changyang district of Hupeh. Loc. N. (By 7, 218).

Syntypes: Cat. N. (7659,7662-63).

Genus *Trinota* (gen. nov.)

Genotype: *Trinota costata* Hou (gen. et sp. nov.)

Diagnosis: Carapace oval, elongated in lateral view; ends obtuse, rounded, dorsum and venter almost straight or slightly concave. Carapace ornamented by three nodes and a ventral ridge; one conspicuous node just above the median pit, another two nodes before and behind it. The ridge is located below the median pit near the center of the shell.

Surface finely reticulate. Free margin rounded by a ridge or by a thick flange from antero-dorsal to postero-dorsal, and reversed by furrow. The characters of both valves are similar. The overlap and hingement unknown.

A relationship between *Trinota* and the Upper Devonian genus *Mennerites*

Egorov from Russia is indicated by their lateral outline, ventral ridge and conspicuous pit. The genus *Trinota* are, however, trilobed at or near the dorsum, and this genus is further differentiated by the absence of the postero-dorsal spine in the immature stage; that is a thick flange in the left and right valves along the free margins.

Geological range: Upper Devonian, Hupeh Province.

Trinota costata Hou (sp. nov.)

(Pl. 8, figs. 22-26)

Description: Carapace elongate, oval in side view, dorsum and venter nearly straight or slightly concave, with the latter sometimes more concave. Ends rounded, with the anterior end only very slightly higher. Cardinal and ventral angles all rounded. Dorsal view of carapace elongated with almost flattened outline. This species is characterized by a thick ventral flange extending to about the antero- and postero-dorsal margins, and reversed by furrow.

Surface marked by nodes and pits, with conspicuous pit at or near the center, and a median node above the pit. Another one just before it and a third behind it. Sometimes the latter one is inconspicuous. An elongated ventral node or a ventral ridge is developed just below the median pit. Surface finely reticulate. The overlap and hingement are unknown.

Relationships: This species is closely allied to the genus *Mennerites* Egorov 1950 in the external sculpture, but differs from that form in having three nodes arranged in a straight line in the dorsal portion; a thick rounded flange is present on the left and right valves along the free margins instead of the left margin falling into the furrow of the right valve as in *Mennerites*.

Horizon and Locality: It was obtained from Upper Devonian, Changyang district of Hupeh. Loc. N. (By 7).

Holotype: Cat. N. (7666).

Genus *Bernia* Jones 1884

Bernia? sp.

(Pl. 8, figs. 27-37)

Description: Carapace subelliptical or subovate in outline, median sized. Hinge line short and straight, ends rounded with the posterior more evenly rounded; ventral margin convex. Dorsal and ventral angles obtuse. The greatest height lies

just behind the vertical median line. Thickest portion of carapace on the ventral portion with the most gentle slopes toward the dorsal. Surface rather strongly convex, with a rather short sulcus near the dorso-central part and an oval pit of muscular scar in the lower end of the sulcus. One node on each side of the sulcus, the anterior one is small and rounded, the another is swollen and corresponding to the posterior convexity. In the internal mould, some irregular radial line occur from the lower end of the sulcus (indistinctly shown in the figures).

Remarks: This genus was only known in the Carboniferous of Northumberland of England; the discovery of it in the Upper Devonian of W. Hupeh implies that the genus under consideration has appeared in a much earlier period in China.

Horizon and Localities: From Hsiehkingssu formation of Upper Devonian, Changyang district of Hupeh. Loc. N. (By 230, 218).

Syntypes: Cat. N. (7675-78).

Gen. et sp. A (indet.)

(Pl. 1, figs. 18-20)

Description: Carapace truncated, ovate, or suboviform, longer rather high in lateral view; median in size, with moderately convex valve. Dorsum straight meeting the anterior margin at an angle larger than 90 degrees. Posterior broadly rounded, anterior narrow. A hemispherical node is located in the dorsal-central but slightly near posterior, with the valve depressed along the anterior of its base.

The larger right valve overlaps the left along the free margin. The measurement of specimens, one is 1.4 mm in length, 0.98 mm in height, the other is length 1.2 mm, height is 0.83 mm. Surface ornamented by numerous punctae, which are conspicuous in the anterior but faint in the posterior and arranged irregularly.

The specimens under studying occur in the thin-bedded limestone and yellowish clayey limestone occasionally intercalated with shales, they occur as partially exfoliated specimens or as molds.

Horizon and Localities: From the thin bedded limestone of the Upper Devonian, Changyang district of Hupeh. Loc. N. (By 7, By 230).

Cat. N. (7680-81).

Gen. et sp. B (indet.)

(Pl. 1, figs. 1-9, 13)

Description: Carapace small, subovate, hinge straight; slightly shorter than the

total length of the valve. Surface smooth, ornamented by two node-like swellings. Posterior swelling rounded, distinct and somewhat over hanging the hinge line; anterior one inconspicuous. Right valve overlapped the left completely along the free margins from end to end, with the greatest overlap at the ventral, but narrowing regularly toward the cardinal extremities. Pit or depression shallow and narrow, situated at the middle of the dorsal portion. Carapace moderately convex. Maximum length and height at the middle of valve.

With regard to the external structure of this shell, this form is related to both the genus *Sansabella* Roundy and *Leperditella* Ulrich but distinguished from them by its comparatively larger right valve and smaller size of the carapace. A definite generic determination cannot be made until more complete material is available.

Horizon and Localities: It was obtained from the Upper Devonian Hsiehkingssu formation, Changyang district of Hupeh. Loc.. N. (By 7, By 230, By 218).

Cat. N. (7470-79).