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NOTES ON TWO DEVONIAN TRILOBITES FROM THE KITAKAMI MOUNTAINS IN JAPAN

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REPRINTED FROM JOURNAL OF THE FACULTY OF SCIENCE, UNIVERSITY OF TOKYO
SEC. II, VOL. XI, PART I, pp. 1-10, Pl. I, December 20th, 1957

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By

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With Plate I.

Devonian is the least known system in Japan. Fossils of the period are reported from only four places (KOBAYASHI and IGO, 1956). At these localities trolbites are exceedingly rare. One of them is *Cheirurus* (*Crotalocephalus*) *japonicus* KOBAYASHI and IGO, 1956, from the Kimmamichi formation in the Hida plateau which used to be considered Gotlandian, but was proven to be early Middle or late Lower Devonian. At the same time it reveals the affinity of the Kimmamichi fauna with Australia on one side and with Europe through Central Asia and Asia Minor on the other.

Because trilobites are keen indices to the geological age as well as the life province, it is the aim of this study to see how far one can learn out of *Dechenella minima* OKUBO, 1951, and *Bronteus* (*Thysanopeltis*) *paucispinosa* OKUBO, 1951, from the Nakazato series of the Kitakami mountains. The former is represented by a cranidium and the latter by a pygidium. They are, though imperfect, enough to judge OKUBO'S identification. He noted that most species of *Dechenella* are reported from Middle Devonian and *Thysanopeltis* is a subgenus of *Bronteus* which occurs in Europe mostly in Lower and Middle Devonian.

As discussed below, the reference of the former to *Dechenella* of *Dechenella* is quite warranted. Through the monographic works (1921, 1950), R. and E. RICHTER have shown that the subgenus is restricted in Europe and Morocco to the Givetian stage and the species in Yunnan and North America are most probably coeval with the European ones. Therefore *D.* (*D.*) *minima* may not be a non-Givetian exception.

As pointed out by REED (1925), PRANTL and PŘIBYL (1946) and others, two morphic groups can be distinguished in *Scutellum* (*Thysanopeltis*). The *speciosus* group or *Thysanopeltis*, s. str. is so far known only from Europe, while the *acanthopeltis-clementinum* group or *Thysanopeltella*, nov. to which *paucispinosa* belongs occurs in Europe in the Eifel stage and is distributed from the Urals to Eastern Asia through Turkestan. Such a wide distribution of this group is in support of RICHTER'S view (1914) on the pelagic habit of *Thysanopeltis* (*s. l.*). *Scutellum* (*Thysanopeltella*) *paucispinosa* (OKUBO) can briefly be said *Scutellum* (*Scutellum*) *furciferum* (BARRANDE) with a spine issuing from each pleura on the pygidium. Therefore PRANTL and PŘIBYL'S opinion (1946) on the derivation of *Thysanopeltella* from the *furciferum* group of *Scutellum* suites for the origin of *paucispinosa*, although the remote distance can hardly be overlooked.

It is certainly a remarkable fact that *Thysanopeltella* and *Crotalocephalus* are

Received March 4, 1957; read at the 66th meeting of the Palaeontological Society of Japan at Akita, June 15, 1957.

unknown from North America and *Dechenella* s. str. is, though occurs in North America, not so well developed as in Europe. Therefore *these trilobites on the whole indicate the faunal connection between Japan and Europe.* In discussing the early Ordovician palaeogeography (1955) I have shown that the faunal connection was maintained through geosynclines for a long distance. From this viewpoint the transcontinental distribution of these trilobites is of special interest.

Assuming that the homotaxial deviation is negligible for these trilobites, their ages suggested by the geological ranges or the acmic prominence of these subgenera are as follows:

1. *Dechenella* (*Dechenella*) *minima* OKUBO from Hikoroichizawa; Givetian.
2. *Scutellum* (*Thysanopeltella*) *paucispinosa* (OKUBO) from Omorizawa; Couvinian or thereabout.
3. *Cheirurus* (*Crotalocephalus*) *japonicus* KOBAYASHI and IGO from Kimmamichi; Emsian, if not Couvinian.

Here I record my sincere gratitude to the late Prof. R. RICHTER of the Senckenbergiana, Frankfurt am Maine, Prof. Victor VAN STRAEHLEN of the Musée Royal d'Histoire Naturelles de Belgique, Bruxelles, Prof. I. A. BROWNE of the University of Sydney and Dr. K. DOI of the Mineralogical Institute of our university for securing some copies of references.

Family Scutelluidae R. and E. RICHTER, 1925.

RICHTERS' classification (1956) is the latest in which the family divided into 3 genera (*Eobronteus, Scutellum* and *Stoermeraspis*) and 6 subgenera of *Scutellum* (*Kolichapeltis, Paralejurus, Planiscutellum, Scabriscutellum, Scutellum* and *Thysanopeltis*). Here *Thysanopeltella* is segregated from *Thysanopeltis* as a new subgenus of *Scutellum.*

It is noted further that *Bronteus longispinifer* MITCHELL, 1887, from New South Wales has a very small, but relatively broad, well rounded pygidium with entire margins. The conical axial lobe of the thorax, abruptly tapering backwards, is very unusual; its pleurae are protruded into long spines. These aspects are so aberrant that I think that the species indicates an unnamed genus by itself. The associated cranidium, though its Scutelluidae-nature is represented, is unfortunately very imperfect.

Genus *Scutellum* PUSCH, 1833

Subgenus *Thysanopeltella* KOBAYASHI, new subgenus

Diagnosis:—*Scutellum* with spines of definite number on pygidium issuing regularly in accordance with pleural segmentation; axial lobe trilobed; post-axial median rib simple or bifurcate; each spine projected from a branch of the rib or the median groove in bifurcate forms; 7 additional spines on each side.

Type:—*Bronteus acanthopeltis* BARRANDE, 1852.

Remarks:—It has been a moot question whether the marginal spines on the pygidium can be evaluated as generic or subgeneric distinction in the Scutelluidae. While *Thysanopeltis* which is characterized by them was ignored by BARRANDE (1852), REED (1925), WEBER (1932) and others, it was accepted as a valid genus or subgenus by GÜRICH (1909), RAYMOND (1913), RICHTER (1914, 56), MAILLIEUX (1938), PRANTL and PŘIBYL (1946), PRANTL (1949), OKUBO (1951) and HUPÉ (1953, 55).

Thysanopeltis was erected by HAWLE and CORDA (1947) on *Thysanopeltis speciosus* HAWLE and CORDA, but BARRANDE (1852), denying its validity, redefined the species and proposed *B. thysanopeltis* for it. REED distinguished two subgroups in the *Thysanopeltis* group as follows:

1. *Acanthopeltis* subgroup having marginal spines corresponding with ribs in number and position.
2. *Speciosus* group having more numerous spines unrelated to the ribs.

Likewise PRANTL and PŘIBYL recognized two divisions in Bohemian *Thysanopeltis* where their *clementinum* group corresponds to REED's *acanthopeltis* subgroup. According to their recent revision *Scutellum* (*Thysanopeltis*) *speciosus* comprises, beside the typical forms, 3 subspecies, namely *waldschmidti* KOENEN, *abreviatum* PRANTL, and *redividium* PRANTL. BARRANDE's *thysanopeltis* was considered by NOVAK (1890) and WOODWARD (1910) to be distinct from *speciosum*, but indistinct by REED. PRANTL synonymized a part of BARRANDE's *thysanopeltis* with *speciosum* and renamed the remainder or *thysanopeltis* proper as *Scutellum* (*Thysanopeltis*) *speciosum abreviatum*. The species and subspecies occur in Bohemia in the G_α to G_γ stages or Emsio-Couvinian. The other group of *Thysanopeltis* is represented in Bohemia solely by BARRANDE's *clementinum* from the G_β stage i. e. Daleji beds.

FRECH (1887) illustrated *speciosus* as a leading member of the Günsteröder Kalk (Unteres Mitteldevon) and the *Aphyllites fildelis* zone (Oberes Unterdevon). PRANTL referred WALDSCHMIDT'S *thysanopeltis* from Wildungen to *speciosum waldschmidti* and MAUER'S *thysanopeltis* ? from the Kalk von Griedenstein to *speciosum abreviatum*. In Eifel *Thysanopeltis acanthopeltis* SCHNUR occurs in the Eifelian Geeser Mergel of Gerolsteiner and Prumer Mulde together with *Cheirurus* (*Crotalocephalus*) *sternbergi* (RICHTER, 1921). Lately the synonymy of *Bronteus halli* WOODWARD from Gerolstein with *acanthopeltis* was readily confirmed by RICHTERS. *Bronteus laciniatum* SANDBERGER is a multispinose form of *Thysanopeltis* known from the Eifelian Wissbacher Schiefer. It is a question whether *Thysanopeltis barrandei* HÉBERT, 1855, from the Lower Devonian (? lower Coblenz stage) at Fourmies, Ardenne is another multispinose form, because according to BARRANDE (1857) it is analogous with *Dalmanites M'Coyi* BARRANDE.

Thysanopeltis magnispina MAILLIEUX, 1938, is a Couvinian member of Ardenne. On its pygidium 15 ribs are countable on the proximal side but 16 on the distal side probably because the post-axial rib is bifurcated. These radial ribs are generally independent from 24 spines, but evidently longer and less numerous than those of *speciosus*. These spines become longer from lateral to posterior gradually. Insofar as I am aware, five species of *Thysanopeltis* are reported from France as follows:

1. *Bronteus bureaui* TROMELIN et LEBESCONTE, 1876, from the Eifelian(?) at St. Huliend de Vouvantes, Bretagne, in the syncline of Angers in the Armorican massif. This is said to bear some resemblances with *thysanopeltis*, but in the former the spines are smaller and more numerous on the border than in the latter.
2. *Bronteus meridionalis* TROMELIN and GRASS, 1877, from Assise à *Spirifer cultrijugatus* (Eifelien) at Cabriéres, Hérault. Spines along the margin of the pygidium are numerous and extraordinarily minute and pleural ribs broader than those of *speciosum* and its varieties.
3. *Bronteus raphaeli* BARROIS, 1886, from Lower Devonian (between the Coblenzian and E stage) at Hont de Ver, Haute-Geronne, Pyrénes. The beds yield *Phacops fecundus* the occurrence of which is restricted in Bohemia and Germany to the Eifelian in addition to the top of the Coblenzian (GÜRICH, 1909). Therefore it is probable that the age of the beds is Eifelian. Contracted secondarily, the dorsal shield and accordingly the pygidium looks much broader than *speciosum*, but closely resembles that species in the mode of pleural

ribs and furrows and the size and density of the marginal spines.

4. *Bronteus trutati* BARROIS, 1886, from Lower Devonian (or Eifelian) at Hont de Bicoulous, Haut-Geronne, Pyrénes. Ribs on the pygidium are narrower than their flat interspaces and protruded beyond the raised marginal rim for some distance. The presence of a short secondary spine in each interval between two long primaries is the speciality.
5. *Bronteus rouvillei* FRECH, 1887, from the Schichten von Bataille in Cabriéres, Languedoc, which was considered late Middle Devonian, but could be Eifelian, because *Spirifer speciosus* was procured from the beds. Spines of the outer margin are very fine.

Thus, in Europe the *speciosus* group is well represented by many species, namely *laciniatum, barrandei, magnispina, meridionalis, raphaeli* and *rouvillei* beside *speciosus* and its 3 subspecies. Spines vary greatly in number and size, attaining about 60° at the maximum, but their size happens to be so small that they are shown only by high magnification, as in *meridionalis* for example. They are generally same in size on a pygidium, but become larger or longer backward in *magnispina*. The other group comprises *acanthopeltis, clementinum* and *trutati*, the last of which has two kinds of spines. The former group ranges from the Coblenzian to the Eifelian, while the latter is restricted in Europe to Eifelian or Couvinian.

In discussing the monophyletism of *Thysanopeltis*, RICHTERS emphasized that "Für die Zusammengehörigkeit der *acanthopeltis*-Gruppe mit der *speciosum*-Gruppe in einer Untergattung *Thysanopeltis* spricht der übereinstimmende Bau der Rippen. Bei beiden Gruppen sind die Rippen schmale, hohe, scharf begrenzte Leisten zwischen breiten Furchen, deren Boden oft zu Zwischenrippen aufgewölbt sind." They are of opinion that *Bronteus tellius* HALL and CLARKE, 1888, from the Upper Devonian Tully limestone of North America which has the cephalon and pygidium of the *costatum* group, should be excluded from *Thysanopeltis*.

As pointed out already by BARRANDE, the spines are different between the two groups. Namely, in the *acanthopeltis* group the spine is evidently a protuberance of a pleural rib or furrow whereas spines in the *speciosum* group are marginal modification regardless of the segmentation. In the number and size of spines *magnispina* and *trutati* are intermediate between the multi- and pauci-segmented groups, but if the relation of the spines to the segmentation is considered, there is no question about that *magnispina* and *trutati* belong respectively to the *speciosum* and *acanthopeltis* group, although they are aberrant forms in the groups.

The biological bearing of the spine must be greater in the *acanthopeltis* than in the *speciosum* group. As to the geological range in Europe the former is more restricted than the latter group. In the geographical distribution on the contrary the former is more extensive than the latter, because all of the Asiatic species belong to the *acanthopeltis* group, because the distinction of the two morphic groups bears such a geological and geographic bearing and because there is no intermediate form between them, the *acanthopeltis* group is distinguished here from the *speciosum* group as *Thysanopeltella*.

Beside the above mentioned there are four species of *Thysanopeltella* as follows:

1. *Bronteus yakovolevi* WEBER, 1923, from Middle Devonian in the Urals on the river Kamennaia Vogulka in the Lunivsk coal district. (N. N. YAKOVLEV collection).
2. *Bronteus tarak* WEBER, 1923, from Middle Devonian(?) black limestone in association with *Calymene* sp. in the district of Khodgent in the western part of the northern foreland of the Turkestan range. (Locs. 53 and 54, NEUMANN collection).
3. *Bronteus radiatus* WEBER, 1923, from Loc. 23, Turkestan (B. BOERLING collection). Because it is homonymous with *Bronteus radiatus* MÜNSTER, 1840, a new name, *Scutellum* (*Thysanopeltella*) *weberi* is proposed for it in honour of Dr. V. WEBER.
4. *Bronteus* (*Thysanopeltis*) *paucispinosa* OKUBO from Middle Devonian Nakazato series in

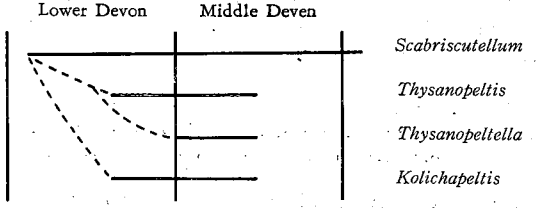
the Kitakami mountains, Japan.

It is a remarkable fact that the post-axial median rib is simple in the three species which WEBER described. In *tarak* and *weberi* it is protruded into a spine, but in *yakovlevi* the rib is expanded in the posterior part where a pair of spines issue. In *acanthopeltis* on the other hand the rib is bifurcated, but there is a single spine which corresponds to the intercalated groove. *Pausispinosa* agrees with *clementinum* in the bifurcation of the median rib and eight pairs of spines each issuing from a pleural rib, and also in the straight articulating margin. In *paucispinosa*, however, the outline of the pygidum is subpentagonal and the margin is shorter than the breadth of the pygidium, while the outline is semiparabolic and the margin represents the maximum breadth in *clementinum*. *Trutati* is not essentially different from *clementinum*, if the short secondary spines are overlooked.

In *weberi* the spines are extraordinarily long, pleural lobes very narrow and the marginal rim is not well developed, but otherwise it is closely allied to *tarak*. Spines are short and subtriangular in *yakovlevi*, *acanthopeltis* and *paucispinosa*, and slender and fairly long in *clementinum* and also *trutati*. Interpleural furrows are narrower than ribs in *weberi* and *tarak*. They disagree with the diagnosis of *Thysanopeltis* s. l. above quoted, but morphic differences among these species of *Thysanopeltella* are gradual.

Nothing is known of the cephalon of *Thysanopeltella*. The cephalon of *Thysanopeltis magnispina*, though its illustration is obscure, appears to resemble that of *speciosum*, as far as can be judged from its description. The complete shield of *speciosum speciosum* shows its closer affinity with *Scutellum umbelliferum* than *S. planiferum* which REED considered the ancester of *Thysanopeltis*. RICHTERS are of opinion that *Thysanopeltis* branched off on one side and *Kolichapeltis* on the other through *Scutellum furciferum* from *Scabriscutellum* which was derived from *umbelliferum*. Before them PRANTL and PŘIBYL suggested *furciferum* for the ancester of *Kolichapeltis* as well as *Thysanopeltis*.

In view of the close affiinity between *furciferum* and *paucispinosa* I am led to the contention that *Thysanopeltis* s. l. or at the least *Thysanopeltella* is located between *Scabriscutellum* and *Kolichapeltis*. Incidentally, *Scutellum* (*Kolichapeltis*) *angusticaudatus* (ETHERIDGE and MITCHELL), 1917, occurs in New South Wales, although no thysanopeltid is known from Australia and according to RICHTHERS, *Goniopeltis* DE KONINCK from New South Wales which was thought a *Thysanopeltis* by KAYSER is something else than the Scutelluidae. The phylogenetical relation of *Thysanopeltella* and its allied subgenera is shown below:



Scutellum (*Thysanopeltella*) *paucispinosum* (OKUBO)

Plate I, Figures 3a–b, 4

1951 *Bronteus* (*Thysanopeltis*) *paucispinosa* OKUBO, *Chikyu-kagaku, No. 4*, p. 137, pl. 1, figs. 5a-c.

Description:—Pygidium a little longer than broad, subpentagonal, but rounded in posterior, attaining to the maximum breadth at a little anterior to mid-length; anterior margin transversal, straight, nearly equal to a half of pygidium length, forming an angle of about 60 degrees at the lateral end. Axial lobe small, triangular and distinctly elevated above nearly flat pleural parts; trilobation very obscure; median part a little rising above its sides; no furrow among them. Facet in scaline trinagle, terminating at a spine; post-axial rib bifurcated in posterior third, each branch ending at a spine; 6 spines on a lateral margin between this and the first spine, each being issued from a pleural rib; pleural furrow a little narrower than rib and die out at a short distance inside of sinuation. Test apparently smooth.

Observation and measurement:—This species is represented by an external and internal mould of a pygidium which is 16 mm. long and its anterior margin 12 mm. wide. The axial lobe measures 3 mm. in length and 4 mm. in breadth. The right side of the pygidium is partly broken off, but if complete, it may be about 15 mm. wide. Because it appears to be secondarily deformed by lateral compression, the original breadth must have been greater than the above mentioned. The roof-shaped angulation of the ribs was probably produced by such compression.

Comparison:—OKUBO compared this species with *Bronteus halli* WOODWARD which is, as noted by RICHTER (1914, 56), identical with *Thysanopeltis acanthopeltis* (BARRANDE).

This is evidently a member of the *acanthopeltis* group, but quite different from *acanthopeltis*, *clementinum*, and *yakovlevi*, all having the maximum breadth on the anterior margin or near to it. In *tarak* and *weberi* the pygidium exclusive of spines becomes broadest at about the mid-length, but there is no antero-lateral facet as seen in this species, the post-axial rib simple and spines are longer in them. Spines are extraordinarily long in *weberi*. In spite of its name this species has eight pairs of spines.

In this species the trilobation of the axial lobe is quite obscure and the post-axial ridge extends from the lobe directly as in *Scutellum* (*Scutellum*) *furciferum* (BARRANDE) with which it agrees in many features so that it may be said spiniferous *furciferum*. *Kolichapeltis parabolium* is elongated and somewhat pentagonal in outline.

Occurrence:—Bryozoa-bearing calcareous black clayslate of the N_3 fossil beds in the upper part of the Nakazato series in the middle part of Omori-zawa, Hikoroichi village, Kesen county, Iwate Prefecture. Early Middle Devonian.

Family Proetidae SALTER, 1862

Subfamily Dechenellinae PŘIBYL, 1946

Genus *Dechenella* KAYSER, 1880

Subgenus *Dechenella* KAYSER, 1880

Type:—*Phillipsia verneuili* BARRANDE.

Dechenella was divided by R. RICHTER in 1912, into *Eudechenlla*, *Paradechenella*

and *Basidechenella*, where the first was later synonymized with subgenus *Dechenella* by R. and E. RICHTER. Even with the cranidium only, true *Dechenella* can readily be distinguished from the two other subgenera by its posterior expansion of the glabella, development of the last furrow on the glabella and the erected frontal border. According to RICHTERS (1950), it comprises the followings:

Archegonus aequalis STEINIGER, 1852 (=*verneuili* BARRANDE)
Dechenella (*Euechenella*) *burmeisteri* RICHTER, 1912, from Westfalen
Dechenella (*Dechenella*) *gigouti*, RICHTER, 1950, from Morocco
Dechenella (*Eudechenella*) *granulata*, RICHTHR, 1912, from Eifel
Dechenella polonica GÜRICH, 1896, from Polonisches Mittelgebirge
Dechenella rittergensis ZIMMERMANN, 1892, from Mähren
Dechenella romanovski TSCHERNYSCHEW, 1887, from Ural.
Dechenella setosa WHILDBORNE, 1889, from Devonshire.
Dechenella (*Dechenella*) *struvei* RICHTERS, 1900, from Hillesheimer Mulde.

RICHTERS noted the possible reference of three additional species to the same subgenus as follows:

Proetus haldemanni HALL, 1888, from New York.
Proetus nortoni WALTER, 1920, from Iowa.
Dechenella sp. aff. *D. macrocephala* HALL by PATTE, 1929, from Tsche Ts'ouen near Amitcheou, Yunnan.

They however, excluded *Dechenella* (*Dechenella*) *mackayi* ALLAN from New Zealand from *Dechnella*. Finally, *Dechenella minima* OKUBO is diagnostic of *Dechenella* of *Dechenella*.

Distribution:—Givetian of Europe (Bohemia, Harz, Rhineland, Devonshire, Poland and Ural) and North America (New York and Iowa) and Eastern Asia, (Yunnan and Japan).

Dechenella (*Dechenella*) *minima* OKUBO

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Plate I, Figures 1a-b, 2a-b

1950 *Dechenella minuma* OBUBO, *Chikyu-Kagaku, No. 4*, p. 28, pl. 1, figs. 6a-c.

Description:—Cranidium broad, its breadth measured through palpebral lobes a little longer than its length; glabella very large, subovate, so long as to reach the frontal groove, abruptly and strongly swelling above cheeks, giving somewhat bulbous appearance, more or less contracted at the mid-length of glabella exclusive of neck ring and thence well expanded; anterior portion relatively broad for genus and well rounded in front; dorsal furrow narrow and weak.

Four pairs of lateral furrows considerably different in strength; first furrow almost a pit at a point a little posterior to the middle of anterior portion of glabella; second one diagonal, somewhat arcuate, fairly long and pronounced near glabellar margin, but weakened gradually inward; third one subparallel to the preceding, a little longer and stronger and seemingly strengthened at a short distance from the inner end; fourth furrow nearly parallel to and incomparably stronger than the third and confluent with strong transversal occipital furrow, while others are disconnected on axial portion.

Frontal lobe a little longer than lateral lobes which are in turn similar in length; last lobe in particular depressed and isolated from main body of glabella by the fourth furrow, forming an elliptical embossment; axial part of the third lobe

somewhat protruded back between the pair of such bosses and slightly hanging over occipital furrow; occipital ring broad.

Fixed cheek very narrow; palpebral lobe presumably large; palpebral furrow obscure. Frontal border roof-shaped, more steeply inclined forward than backward; facial sutures apparently diagonal and intramarginal on two sides of frontal border.

Observation:—This species is represented by a cranidium of which fixed cheeks are poorly preserved. The axial part of the glabella proper may be more pointed back than illustrated, if the part is undamaged. The occipital ring is strongly bent down on the two sides. There the basal lobe on the right side is protruded above the dorsal furrow and the postero-inner corner of the cheeck subvertical; there is no tubercle at this place as often seen in this genus. The frontal border has no median casp. Because the test is oxydized, it is difficult to say about texture, but the frontal lobe which is least altered, appears to be roughened by granules.

Comparison:—As to *Trilobites verticalis* BURMEISTER, 1843, to which OKUBO compared this species, RICHTER gives a mention that "*Mischgebilde mit einem nicht mehr bestimmbaren Dechenellenbestandteil.*" *D. (E.) burmeisteri* was proposed by him for *verticalis* by SCHULTER (1880), KAYSER (1880) and OEHLERT (1885).

In the outline of the glabella and lack of the frontal limb this agrees with *polonica*, but differs in the strength and course of lateral furrows and other features. With regard to these furrows it is more allied to *verneuili*, *burmeisteri* and *struvei*, but the glabella is broader and a narrow space always present between the glabella and frontal border. The last lateral furrow joins with the occipital one in *struvei* and *burmeisteri* and the axial part is pointed back in *burmeisteri*, but not so protruded as in this. In that species the occipital furrow is arched, instead of transversal, and provided with a tubercle near the lateral end.

Occurrence:—Nakazato series in the middle part of Higuchizawa, Hikoroichi-village, Kesen County, Iwate Prefecture. The trilobites suggests that this horizon is higher than that of *Thysanopeltella minima*.

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Synoptic List of *Thysanopeltis* and *Thysanopeltella.*

Thysanopeltis speciosa HAWLE and CORDA, 1847 ..... *Thysanopeltis*
Bronteus thysanopeltis BARRANDE, 1852 ..... *Thysanopeltis*
Bronteus acanthopeltis BARRANDE, 1852 ..... *Thysanopeltis*
Bronteus clementinum BARRANDE, 1852 ..... *Thysanopeltella*
Bronteus barrandei HÉBERT, 1800 ..... ? *Thysanopeltis*
Goldeus bureaui TROMELIN-LEBESCONTE, 1876 ..... *Thysanopeltis*
Bronteus meridionalis TROMELIN-GRASS, 1876 ..... *Thysanopeltis*
Bronteus waldschmidti KOENEN, 1882 ..... *Scutellum* (*Thysanopeltis*) *speciosum waldschmidti*
Bronteus raphaeli BARROIS, 1886 ..... *Thysanopeltis*
Bronteus trutati BARROIS, 1886 ..... *Thysanopeltella*
Bronteus rouvillei FRECH, 1887 ..... *Thysanopeltis*
Bronteus laciniatum SANDBERGER, 1891 ..... *Thysanopeltis*
Bronteus halli WOODWARD, 1910 ..... *Scutellum* (*Thysanopeltella*) *acanthopeltis*
Bronteus tarak WEBER, 1923 ..... *Thysanopeltella*
Bronteus yakovlevi WEBER, 1923 ..... *Thysanopeltella*
Bronteus radiatus WEBER, 1923, non MÜNSTER, 1840 ..... *Scutellum* (*Thysanopeltella*) *weberi*
Thysanopeltis magnispina MAILLIEUX, 1938 ..... *Thysanopeltis*
Scutellum (*Thysanopeltis*) *speciosum revidium* PRANTL, 1949 ..... *Thysanopeltis*
Scutellum (*Thysanopeltis*) *speciosum abreviatum* PRANTL, 1949 ..... *Thysanopeltis*
Bronteus (*Thysanopeltis*) *paucispinosa* OKUBO, 1951 ..... *Thysanopeltella*
Scutellum (*Thysanopeltella*) *weberi* KOBAYASHI, 1957 ..... *Thysanopeltella*

T. KOBAYASHI

Notes on two Devonian Trilobites from the Kitakami Mountains in Japan

Plate I

Explanation of Plate I

Figures 1a–b. *Dechenella* (*Dechenella*) *minima* OKUBO ..... p. 7
Figures 2a–b. Ditto, fixed cheeks restored. ..... p. 7
Figures 3a–b. *Scutellum* (*Thysanopeltella*) *paucispinosa* (OKUBO) ×2. External and internal moulds. ..... p. 5
Figure 4. Ditto, restoration. ..... p. 5
Figure 5. *Scutellum* (*Thysanopeltella*) *yakovlevi* (WEBER) ..... p. 4
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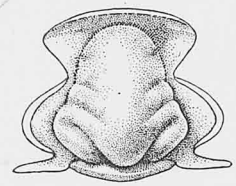
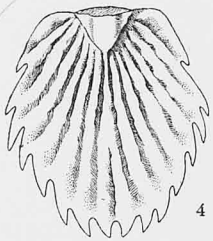
Figure 10. *Scutellum* (*Thysanopeltella*) *acanthopeltis* (BARRANDE) ..... p. 2


2a


2b


1a PA8006


1b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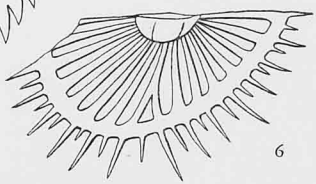
3b


5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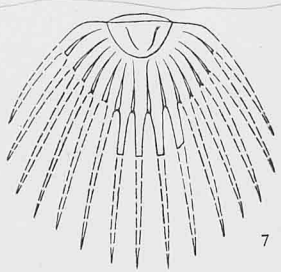
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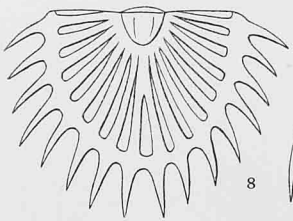
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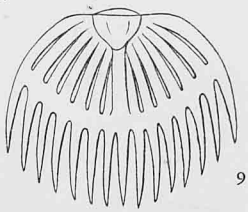
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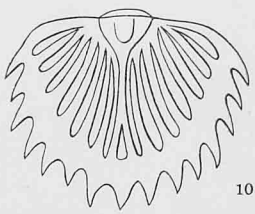
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