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朝鲜南部的 *Pseudoglyptagnostus*(三叶虫)并论朝鲜寒武纪斜坡相的意义

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提要　朝鲜南部 Machari 组 *Olenoides* 带的 *Agnostus* (*Ptychagnostus*?) *orientalis* Kobayashi 一种应归于 *Agnostotes* (*Pseudoglyptagnostus*) Lu，1964 一属，时代是晚寒武世长山期，不是早期中寒武世。小林贞一的 *Olenoides* 带是中及晚寒武世三叶虫混杂在一起的一个化石带。他建立的该组 5 个化石带也有问题。*Coreolenus*，*Cheiruroides*，*Pagetia*，*Oryctocephalus*，*Tonkinella*，*Glyptagnostus*，*Pseudoglyptagnostus*，*Hedinaspis* 在朝鲜北部中和及朝鲜南部闻庆、宁越等地区，早至晚寒武世地层内的存在，说明上述地区为斜坡相区。这一斜坡相区依附于华北或中朝地台边缘并向着太平洋一方。朝鲜的斜坡相区是华南江南带从越南北部经广西西部、贵州东部、湖南西部、江西北部、安徽南部、浙江西部、江苏南部(包括上海地区)，呈东北方向伸向朝鲜。江南带是连续的，在地理位置上没有位移。这清楚地显示中朝地台及扬子地台(或有些作者所指的华北地块及华南地块)，如现代地理图上所指的，仍然保持北、南的地理位置。寒武纪中朝地台及扬子地台可能属于同一个大的地台区，没有位移或分离的证据。*Agnostus* (*Ptychagnostus*?) *orientalis* Kobayashi，1935 及与其共生的 *Irvingella* sp.，*Pseudagnostus* sp. 3 种这里作了新的记述。*Komaspis* Kobayashi，1935 可能是 *Irvingella* Ulrich and Resser，in Walcott，1924 属的次定同物异名(junior synonym)。小林贞一的 *Komaspis* 及 *Eochuangia* Kobayashi，1935 两属的时代是晚寒武世长山期(*Changshania-Irvingella* Zone)，不是中寒武世的三叶虫。南朝鲜的 *Olenoides* 带建议改为 *Tonkinella* 带，因为后者在世界范围的分布更广。

关键词　三叶虫　朝鲜寒武纪　斜坡相　中朝及扬子地台　漂移

OCCURRENCE OF *PSEUDOGLYPTAGNOSTUS* (CAMBRIAN TRILOBITA) IN SOUTH KOREA AND THE SIGNIFICANCE OF THE SLOPE BIOFACIES OF KOREA

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Abstract: *Agnostus* (*Ptychagnostus*?) *orientalis* Kobayashi，1935 from the *Olenoides* Zone of the Machari Formation of South Korea，is a species of *Agnostotes* (*Pseudoglyptagnostus*) Lu，1964，which is an agnostoid trilobite of medial Late Cambrian age rather than early Middle Cambrian. Kobayashi used the *Olenoides* to denominate a mixed zone of trilobites of Middle and Late Cambrian ages，and his 5 biozonations for the Machari Formation are incorrect. The occurrence of *Coreolenus*，*Cheiruroides*，*Oryctocephalus*，*Pagetia*，*Tonkinella*，*Glyptagnostus*，*Pseudoglyptagnostus* and *Hedinaspis* of Early to Late Cambrian age in Chunghwa，North Korea and in Neietsu and Bunkei，South Korea，shows the presence of a slope biofacies，which should be affiliated with the North China Platform，as the side facing the Pacific Ocean. This slope biofacies in Korea，was the northeast extension of the Chiangnan Belt of South China，where a continuous belt of slope biofacies with southwest-northeast direction，existed from North Vietnam，via southwest Guangxi，eastern Guizhou，western Hunan，northern Jiangxi，southern Anhui，western Zhejiang，southern Jiangsu (including Shanghai) to Korea. This belt is continu-

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ous without any serious geographical displacement. It clearly shows that the North China (or Sino-Korean) and Yangtze Platforms, or "Blocks" of some authors, have kept their northern and southern geographical positions as shown on the present geographical map, they probably belonged to one larger platformal area, and there is no separation of the North and South China Blocks during the Cambrian, as many authors have indicated in different reconstruction maps for Cambrian paleogeography (e. g., Lin, Fuller and Zhang, 1985; Zhao and Robert, 1987). *Agnostus* (*Ptychagnostus*?) *orientalis* Kobayashi and its associated species of *Irvingella* and *Pseudagnostus*, are redescribed and refigured. *Komaspis* Kobayashi, 1935 may be a junior synonym of *Irvingella* Ulrich and Resser, in Walcott, 1924. *Komaspis* and *Eochuangia* are of Late Cambrian Changshanian age rather than Middle Cambrian as suggested by Kobayashi in 1935.

Key words: Korean Cambrian, slope litho- and biofacies, Sino-Korean and Yangtze Platforms, drift

In the early 1980's, when Sun (1989) began to study the Cambrian agnostoid trilobites from the North China (or Sino-Korean) Platform at the Nanjing Institute of Geology and Palaeontology I had the opportunity to inspect the latex moulds of the type material of agnostoid trilobites from South Korea described by Kobayashi (1935). They had been presented to the Institute by J. Shergold many years ago. This short note reports the occurrence of *Pseudoglyptagnostus orientalis* (Kobayashi) from the Machari Formation, the significance of the slope biofacies of Korea and the generic status of *Komaspis* Kobayashi, 1935 as well as the stratigraphic position of *Komaspis* and *Eochuangia* in South Korea.

OCCURRENCE OF *Pseudoglyptagnostus* AND BIOSTRATIGRAPHY OF THE MACHARI FORMATION

Kobayashi (1935) described *Tonkinella breviceps* Kobayashi, *T. orientalis* Kobayashi, *Agnostus* (*Ptychagnostus*?) *orientalis* Kobayashi, *Komaspis convexus* Kobayashi, *Komaspis typa* Kobayashi (type species of *Komaspis*) and *Eochuangia hana* Kobayashi (type species of *Eochuangia*) from the *Olenoides* Zone of the lower unit of the Machari Formation of South Korea. Five trilobite zones defined for the Machari Formation, in ascending order, were as follows: *Olenoides*, *Eochuangia*, *Komaspis-Koptura-Iwayaspis*, *Olenus-Glyptagnostus*, and *Hancrania* Zones (Kobayashi, 1956, 1962, 1966). The upper part of the formation is characterized by alternations of thin-bedded bluish-gray dolomitic limestone and finely laminated black shale beds. The middle part, where *Glyptagnostus* occurs, is dominated by dark gray to black laminated shale with occasional intercalations of thin dolomitic limestone beds. The lower part, yielding *Olenoides* and *Tonkinella*, comprises dark gray dolomitic limestone, shale and limestone breccia (Choi and Lee, 1995). The Machari Formation is of Middle to Late Cambrian age and attains a thickness up to 400 m.

Species of *Tonkinella* have a wide geographical distribution: Utah, Nevada, and Newfoundland (Sundberg, 1994), Kashmir (Reed, 1934; Kobayashi, 1934), North Vietnam (Mansuy, 1912, 1916), southeast Yunnan (Luo, 1984), Shandong, western Henan and southern Liaoning (Chang, 1957, 1988; Chang *et al.*, 1995), North and South Korea (Kobayashi, 1935), northern Siberia (Tschernysheva, 1962; Astashkin *et al.*, 1991, column 14), eastern Sayan and northwestern Mongolia (Astashkin *et al.*, 1995). Species of *Tonkinella* from Siberia, Mongolia and North America occur in the *Triplagnostus gibbus* Zone (Astashkin *et al.*, 1991; Astashkin *et al.*, 1995; Sundberg, 1994; Whittington, 1995) and species of *Tonkinella* found from Kashmir, North Vietnam, southeast Yunnan and Korea should be of the same age. In North China, the Hsuchuangian *Poriagraulos* Zone contains species of *Tonkinella*, and the superjacent *Bailiella* Zone contains *Ptychagnostus sinicus* Lu. According to Robison (1984) this agnostoid species is a junior synonym of *Ptychagnostus intermedius* which is an important member of the *Triplagnostus gibbus* Zone in North America. Therefore, these two zones are considered to be equivalent to the *T. gibbus* Zone.

Specimen of *Agnostus* (*Ptychagnostus*?) *orientalis* Kobayashi represented only by one fragmentary pygidium occurs in association with a less complete cranidium of *Irvingrella* and a well preserved cephalon of *Pseudoagnostus* on the same piece of rock (Text-figs. 1A, 1C and 1D). Judging from the features of this fragmentary pygidium, this species should be referred to *Pseudoglyptagnostus* Lu, 1964, rather than *Ptychagnostus*. Opik (1963, p. 44) assigned it to *Agnostotes*. Lu's genus is of mid-Changshanian age (middle Late Cambrian) in the Chinese Cambrian biostratigraphic scheme. Now, it is clear that Kobayashi's *Olenoides* Zone is a mixed zone of trilobites of early Middle Cambrian and middle Late Cambrian ages. The species of *Komaspis* described by Kobayashi (1935) may be referred to *Irvingella*. This genus is widely distributed and has been reported from

central England (Rushton, 1983), Siberia (Astashkin *et al*., 1991; Astashkin *et al*., 1995), Kazakhstan (Ergaliev, 1980), China (Lu *et al*., 1965), Australia (Opik, 1963) and North America (Walcott, 1924; Palmer, 1965). In North and Northeast China, *Irvingella* occurs in the shelf biofacies within the *Changshania-Irvingella* Zone, while in South and Western China, it occurs with the agnostoid trilobite *Pseudoglyptagnostus* in the slope biofacies of the Chiangnan Belt and eastern Tienshan foldbelt. In the Khara-Ulakh region of northern Siberia and the Malyi Karatau of southern Kazakhstan, *Irvingella* also co-exists with *Pseudoglyptagnostus*. Therefore, *Irvingella* is an eurytopic genus. In Salair, in the Altay-Sayan foldbelt, the *Glyptagnostus* bed is succeeded immediately by beds with *Irvingella* and *Olenaspella*. In Australia, *Irvingella* co-occurs with *Agnostotes* in the *Irvingella* Zone of the basal Iverian Stage (Shergold, 1993).

Lu (1964) first published *Pseudoglyptagnostus* as a separate genus. Later he considered that it should be a subgenus of *Agnostotes* Opik, 1963(Lu and Lin, 1989). As pointed out by Lu and Lin (1989) and Shergold *et al*. (1990), *Pseudoglyptagnostus* is a senior synonym of *Glyptagnostotes* Lazarenko, 1966. *Pseudoglyptagnostus* is differentiated from *Agnostotes* in having strong scrobiculation on both cephalic and pygidial shields and strong accessory furrows defining a deuterolobe. Lu and Lin stressed the evolutionary relationship of *Pseudoglyptagnostus* with *Glyptagnostus*, and put this genus into the family Glyptagnostidae Whitehouse, 1936, while Shergold *et al*. (1990), Peng (1992) and Shergold and Laurie (1997) considered that *Agnostotes* (*Pseudoglyptagnostus*) should be referred to the subfamily Pseudagnostinae under the family Diplagnostidae Whitehouse, 1936. *Agnostotes* and *Pseudoglyptagnostus* which are indices of middle Late Cambrian age, have been used as denominating fossils for the *Agnostotes*, or *Pseudoglyptagnostus*, or *Pseudoglyptagnostus-Irvingella* Zone in the slope biofacies of western Zhejiang or western Hunan, both in the Chiangnan Belt of South China, and Xinjiang Uygur Autonomous Region, western China (Lu and Lin, 1989; Xiang and Zhang, 1985). This zone marks a definite biostratigraphic unit for middle Late Cambrian, and can be correlated with the *Changshania-Irvingella* Zone of North and Northeast China, the *Ivshinagnostus ivshini* Zone of Kazakhstan, the *Irvingella* Zone of Australia and Siberia, the *Elvinia* Zone of North America, and the *Olenus scanicus* Subzone of the *Olenus-Homagnostus obesus* Zone of Scandinavia, England and Wales.

So far as I am aware, *Eochuangia* is also a trilobite genus in the *Changshania-Irvingella* Zone of the Changshaian Stage of mid Late Cambrian in North China, rather than Middle Cambrian (Qian, 1994). It seems clear that *Eochuangia*, *Komaspis*, *Irvingella* and *Pseudoglyptagnostus* have the same stratigraphic position in South Korea. *Komaspis* may be a junior synonym of *Irvingella*. If *Hedinaspis* and *Westergaardites* really occur in the *Hancrania* Zone, this zone will be of late Late Cambrian age.

From the facts mentioned above, it is evident that Kobayashi's (1935, 1962, 1966) biozonation for the Machari Formation is incorrect as already mentioned by Shergold (1980) and Choi and Lee (1995). It seems desirable to make an extensive revision of the biostratigraphy as well as the trilobites taxonomy of both North and South Korea, because the Cambrian trilobites sequences of the shelf biofacies in North and Northeast China (Chang and Jell, 1987), and of the slope biofacies in South and West China, have been already studied and published (Peng, 1987, 1992; Lu and Lin, 1989; Xiang and Zhang, 1985). From the occurrences of agnostoid and polymeroid trilobites in the Machari Formation of South Korea, it is possible to recognize at least four, or five fossil zones, in ascending order, as the *Tonkinella* (= *Olenoides* Zone), *Glyptagnostus stolidotus*, *Glyptagnostus reticulatus*, *Pseudoglyptagnostus*, and perhaps *Hedinaspis* Zones. It is better to use the *Tonkinella* Zone instead of *Olenoides* Zone because *Tonkinella* is an eurytopic genus and an index for age equivalent to the *Triplagnostus gibbus* Zone, as used earlier (Chang, 1988).

Kobayashi (1944) also described late Late Cambrian trilobite *Hedinaspis* from the Machari (Neietsu) and Bunkei areas of South Korea. *Hedinaspis*, which is a polymeroid trilobite of the slope biofacies, appears always in the late Late Cambrian immediately above the *Pseudoglyptagnostus* Zone, in China, Kazakhstan, Australia and North America. It is also an important index trilobite genus for the late Late Cambrian biostratigraphy in South Korea. If the Korean palaeontologists could find the exact stratigraphic position of *Hedinaspis* around the Machari or Yeongweol area, the *Hedinaspis* Zone may also be added to the Cambrian biostratigraphy of Korea. Perhaps late Middle Cambrian agnostoid trilobites, or some polymeroid trilobites of the slope biofacies, such as *Triplagnostus gibbus*, *Ptychagnostus atavus*, *P. punctuosus*, *Lejopyge laevigata*, *Fuchouia*, *Palaeadotes*, etc., may be found ultimately within the interval between the *Tonkinella* and *Glyptagnostus stolidotus* Zones in the Machari Formation in South Korea.

SIGNIFICANCE OF THE SLOPE BIOFACIES OF KOREA

From the evidence of trilobite fauna of the Machari Formation in South Korea mentioned above, it is clear that a typical slope biofacies of Middle and Late Cambrian age exists there. More than thirty years ago, a transitional belt, called Chiangnan, or Jiangnan Belt was recognized between the Yangtze Platform and the Southeast China foldbelt (Chang, 1962; Chang *et al*., 1964). This belt extends in a northeast-southwest direction for more than 2 800 km, and has a width of ca. 200 km along the southeastern margin of the Yangtze Platform. To the northeast it continues into South Korea, and southwestwards into northern Vietnam, and has the characteristics of a miogeocline, as defined by Dietz (1972). Its basement consists of pre-Sinian slate and phyllite on which Sinian and Lower Palaeozoic sediments were laid down with angular unconformity. The Sinian, the Early Cambrian and Silurian consist mainly of detrital rocks, but the interval from the Middle Cambrian up to the Ordovician consists chiefly of carbonates. The Cambrian lithofacies of this belt are represented by dark gray or black silty and shaly sediments, often in association with dark-coloured limestone, quite different from those of the western platform and the eastern foldbelt deposits. The rocks of this belt appear to have been deposited on the ocean-facing side of a carbonate platform. The biofacies is characteristised by a pandemic agnostoid fauna mixed with open-shelf polymeroids trilobites.

Global distribution of major Cambrian trilobite fauna has been explained in terms of restricted and unrestricted access to open ocean (Palmer, 1973; Robison, 1975), or shelf and slope biofacies (Taylor and Cook, 1975). The Yangtzean, or North China, fauna is equivalent to the shelf biofacies, while the Chiangnan fauna represents the slope biofacies. It seems clear that the biofacies are controlled by lithofacies and by tectonics. For instance, the Chiangnan Oldland refers to a belt of Late Proterozoic slightly metamorphosed phyllites and slates, and was first recognized as a tectonic unit in South China by T. K. Huang (1945). Following a study on the Ordovician and Cambrian biostratigraphy of South China (Chang, 1962; Chang *et al*., 1964), I distinguished the Chiangnan Belt, with its different litho- and biofacies from the platformal carbonates in the west and from the Southeast China foldbelt deposits to the southeast. At the same time, I recognized that the western Queensland and the Eastern European Platform have the same tectoinc setting with similar Cambrian biofacies to that of the Chiangnan Belt. The belt of slope biofacies of western North America (Taylor and Cook, 1975) and the northern marginal belt of North China Platform, as well as the Chiangnan Belt, have similar tectonic setting and the same Cambrian pandemic agnostoid and open-shelf polymeroid trilobite faunas.

The Chiangnan Belt is composed of at least three geographically parallel or subparallel belts of slope biofacies of different age: Early Cambrian, early Middle Cambrian, and late Middle to Late Cambrian. These geographically parallel belts migrated gradually becoming younger from the west platformal side toward the east or southeast, i.e., the ocean-facing direction. A similar case also occurs in Korea, where in the Chunghwa (Chuwa) area, North Korea, the Lower Cambrian *Coreolenus*, *Cheiruroides*, and the early Middle Cambrian *Pagetia*, *Oryctocephalus* trilobite fauna indicate slope biofacies of older ages. Whereas in the Neietsu and Bunkei areas, in South Korea, the trilobites *Tonkinella*, *Glyptagnostus*, *Pseudoglyptagnostus*, *Hedinaspis* and *Westergaardites*, etc, indicate slope biofacies of late Middle to Late Cambrian ages.

There is a question about whether the slope biofacies of Korea should be affiliated with the Yangtze Platform, or with the North China, or Sino-Korean Platform. So far, no one has discussed this problem since the Chiangnan Belt was first recognized in 1962. Judging from geographical considerations, Korea is Northeast China's neighbour across the Yalu River; and from geological conditions, the stratigraphical development of Korea is similar to that of North China, or the Sino-Korean Platform rather than to the Yangtze Platform. For example, late Ordovician, Silurian and Devonian deposits are absent in Korea, and coal bearing Permo-Carboniferous rocks usually disconformably overlie the Middle Ordovician limestone, as is the case on the North China Platform. For these reasons, I am inclined to believe that the slope litho- and biofacies of Korea should be affiliated with the North China Platform. If this is really the case, the North China and Yangtze Platforms should have kept the same northern and southern geographical positions as shown, more or less, on the present geographical map, and they probably originally belonged to one platformal area. There was no separation of the North and South China Blocks during the Cambrian time, in contrast to the opinions of other authors indicated in their different reconstructions of east Asian Cambrian paleogeography (e. g. Lin, Fuller and Zhang, 1985; Zhao and Robert, 1987). The reason is that the Chiangnan Belt is affiliated with both the Yangtze and North China Platforms. This belt is continuous without

any serious displacement from North Vietnam, via southwest Guangxi, eastern Guizhou, western Hunan, northern Jiangxi, southern Anhui, western Zhejiang, southern Jiangsu (including Shanghai) to Korea.

DESCRIPTION OF A FEW TRILOBITES FROM THE MACHARI FORMATION

Family Diplagnostidae Whitehouse, 1936

Subfamily Pseudagnostinae Whitehouse, 1936

Genus *Agnostotes*? pik, 1963

Subgenus *Agnostotes* (Pseudoglyptagnostus) **Lu, in Wang, 1964**

Type species: *Pseudoglyptagnostus clavatus* Lu in Wang, 1964

Agnostotes (Pseudoglyptagnostus) orientalis (**Kobayashi, 1935**).

(Text-figs. 1A, 1B)

1935 *Agnostus* (*Ptychagnostus*?) *orientalis* Kobayashi, p. 105, pl. 14, fig. 12.

1963 *Agnostotes orientalis*, Opik, p. 44.

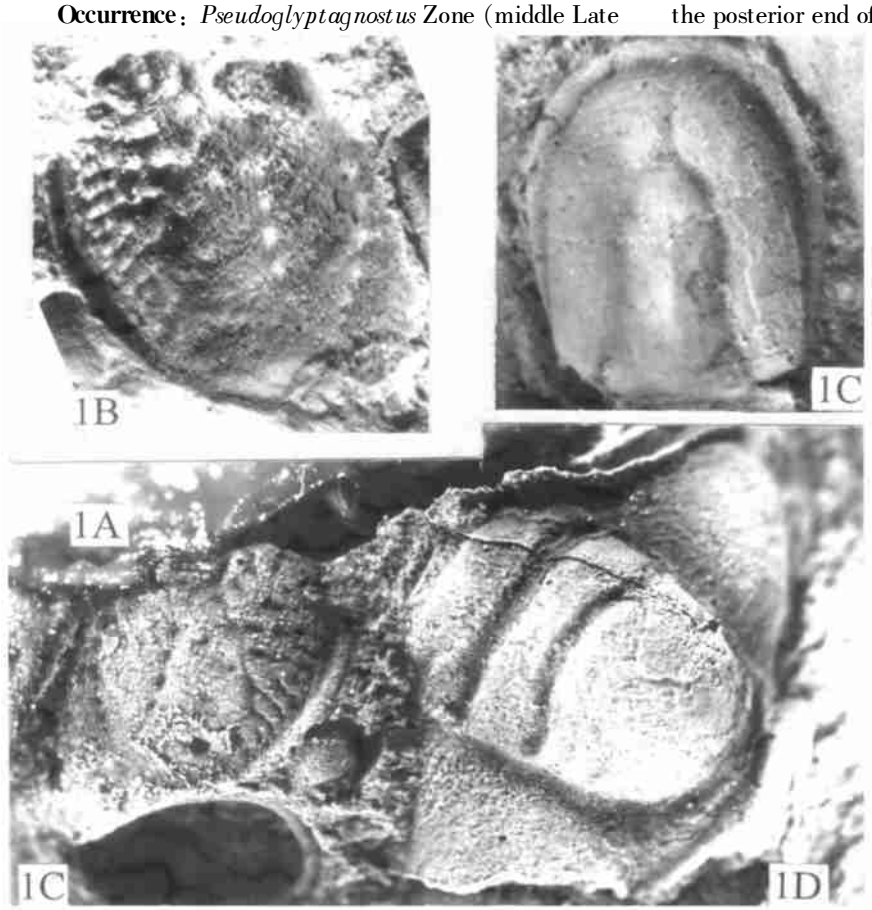
Occurrence: *Pseudoglyptagnostus* Zone (middle Late Cambrian) of the Machari Formation, Yeongweol area, South Korea.

Material: Latex mould of holotype, one fragmentary pygidium.

Repository: Cat. no. PA0957, University Museum, University of Tokyo, Japan.

Descriptoin: This species is repesented by only one fragmentary pygidium. Pygidium semielliptical in outline, strong scrobiculate; border furrow shallow, border narrow and flat, slightly wider posterolaterally, a small posterior lateral spine is broken off. Axis is broad, the first and second axial segments (M1, M2) not preserved. Deuterolobe pyriform, delimited laterally by distinct and narrow accessory furrow, divided longitudinally into 3 parts by 2 curvilinear lines of 6 pairs of pits and a terminal pit; finishing a short distance anterior to the posterior border furrow.

Remarks: This species is very similar to *Agnostotes* (*Pseudoglyptagnostus*) *clavatus* Lu, in strong scrobiculation of the pygidium, the shape of the deuterolobe and the curvilinear lines of pits. The shape of the intranotular axis of *orientalis* tapers backward to a point, but in the holotype of *clavatus*, the notular furrows are subparallel and the posterior end of intranotular axis is more or less blunt.



Text-fig. 1 A, B. *Agrostotes* (*Pseudoglptagnostus*) *orientalis* Kobayashi, type-specimen, ×10, ×12; internal and external moulds; UMUT-PAO957.; C. *Pseudognostus* (*p.*) sp., ×16; D. *Irvingella* sp., ×10.

Text-fig. 2 *Agnostotes* (*Pseudoglyptagnostus*) *clavatus* Lu, type-specimen, ×10, western Zhejiang, China.

In other pygidia of *clavatus*(Lu and Lin, 1989, pl. 6, figs. 2, 3, 6, 7; Peng, 1992, figs. 10, O, Q, R, S), the shapes of both the intranotular axis and notular furrows are similar to those of *orientalis*. A close comparison is impossible, because cephalon, thorax and anterior part of the pygidium of this Korean species are not preserved. Lu and Lin (1989, p. 90) pointed out that *clavatus* and *orientalis* may be the same species. If this is really the case, *orientalis* will replace *clavatus*, as the type species of this subgenus. Anyhow, new collection of well-preserved specimens of this species is necessary.

Genus *Pseudagnostus* Jaekel, 1907

Type species: *Agnostus cyclopyge* Tullberg, 1880

Pseudagnostus (Pseudagnostus) **sp.**
(Text-fig. 1C)

Occurrence: *Pseudoglyptagnostus* Zone (middle Late Cambrian) of the Machari Formation, Yeongweol area, South Korea.

Material: Latex mould of a cephalon, the original specimen occurred in association with *Pseudoglyptagnostus orientalis* (Kobayashi, 1935) on the same piece of rock.

Repository: University Museum, University of Tokyo, Japan.

Description: Cephalon subelliptical, slightly longer than wide; weak preglabellar median furrow. Border furrow shallow, border narrow. Glabella rounded anteriorly, acutely rounded posteriorly; anterior lobe semicircular; posterior lobe cylindrical with flanks slightly constricted, glabellar node elongate. Basal lobes triangular.

Remarks: This specimen seems slightly compressed laterally. The cephalon is similar to *Pseudagnostus* (*Pseudagnostus*) *vastulus* Whitehouse, 1936 from the *Pseudoglyptagnostus* Zone of the Bitiao Formation of western Hunan (Peng, 1992).

Family Komaspididae Kobayashi, 1935

Genus *Irvingella* Ulrich and Resser, in Walcott, 1924

Type species: *Irvingella major* Ulrich and Resser, in Walcott, 1924.

***Irvingella* sp.**
(Text-fig. 1D)

Occurrence: *Pseudoglyptagnostus* Zone (middle Late Cambrian) of the Machari Formation, Yeongweol area, South Korea.

Material: Latex mould of one cranidium, original specimen occurred in association with *Pseudoglyptagnostus orientalis* (Kobayashi, 1935) on the same piece of rock.

Repository: University Museum, University of Tokyo, Japan.

Description: Only one fragmentary cranidium. Glabella convex and broad (tr.), gently tapering forward, round anteriorly, with 1 or 2 pairs of glabellar furrows, S1 deep and broad (sag.), connected in the middle, bending backward, and isolated from axial furrows; S2 very weak. Occipital furrow broad (sag., exsag.), slightly bending backward; occiptial ring convex, slightly broader (sag., exsag.) than L1. Fixigena broad (tr.) and gently convex. Border convex and narrow (sag., exsag.); preglabellar field narrow (sag., exsag.). Eye lobes not preserved.

Remarks: The specimen is very similar to *Irvingella angustilimbata* Kobayashi, 1938 (Peng, 1992) from the *Pseudoglyptagnostus* Zone of the Bitaio Formation of western Hunan in glabellar shape and narrow preglabellar field.

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