

# Conodonts from the Upper Cambrian formations, Kangweon-Do, South Korea

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**ABSTRACT:** 8 form species referable to 5 form genera are described from two Upper Cambrian formations, that is, the Hwajeol- and the Machari Formation which are distributed in Dongjeom-Ri, Samcheok-Gun and in Macha-Ri district, Yeongweol-Gun, Kangweon-Do respectively. The stratigraphic correlation of both faunas generally agrees with the previous attempt based on the study of megafofossils. For detailed stratigraphic setting, however, it needs more sufficient materials.

## 1. INTRODUCTION

Although conodont research has more than a century of history since C.H. Pander (1856), and the cone-like microfossils have been described in nearly all continents from the stratigraphic levels ranging from Cambrian to Triassic, the Cambrian conodont faunas have been less known in comparison with those of other sequences.

According to Professor Müller (1971), who devotes himself strongly to the Cambrian conodont study and is well acquainted with conodont literatures, only 14 reports on the subjects have been published in Europe, North America, Asia and Australia.

In Asia Dr. Nogami (1966, 1967) reported the conodonts from the Kushan- and the Yencho Formation in China and Prof. Müller (1973) found them from the Mila Group in Iran.

In the year 1971 a stratigraphic study on the Lower Paleozoic sequences (the so-called Great Limestone Series) in Kangweon-Do, South Korea was carried out by the faculty members of the Geology Department, Yonsei University.

The writer collected the conodonts, at that time, from two Upper Cambrian formations, namely the Hwajeol- and the Machari Formation.

The purpose of the present work is to classify the conodonts yielded from the above-mentioned formations systematically, and to epitomize briefly the biostratigraphic correlation with the other

previously established faunas in Europe and North America.

The stratigraphic study on the Lower Paleozoic formations by the team of Yonsei University has already been published (Kim, O.J. & Lee, H.Y., 1973).

In this work the taxonomy based on multi-element species could not be adopted owing to deficiency of the obtained conodont specimens.

## 2. ACKNOWLEDGEMENT

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The stereoscan photographs for the illustration were prepared by Mrs. C. Hemmer in "Paläontologischem Institut der Universität Bonn", West Germany, and the drawings for text-figures were finished by Mr. Ja Seon Ku, Geological and Mineralogical Institute of Korea.

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### 3. STRATIGRAPHIC SUMMARY

The Hwajeol (Kasetsu in old Japanese pronunciation) Formation was denominated by Kobayashi (1934) for the Upper Cambrian sedimentary formation which he had divided into C 7 and C 8 Zone in his preliminary work (Kobayashi, 1927) after the geographic name, Hwajeolchi. Hwajeolchi, a pass through a mountain ridge, is situated in Sangdong-Myeon, Yeongweol-Gun, Kangweon-Do, South Korea. The Formation is well distributed in the southern limb of the Baegunsan Syncline located in western part of Samcheok-Gun and eastern area of Yeongweol-Gun. It consists mainly of dark-reddish, or dark green vermicular limestone intercalated by thinly bedded argillaceous rocks and slates. The formation overlies the Sesong Slate and is underlain by the Dongjeom Quartzite with conformity respectively and its thickness is estimated at about 200 m in Dongjeom-Ri where the sample for this study were collected.

The stratigraphic studies on the formation, as well as adjacent ones, have been carried out by the Geological Investigation Corps of Taebaegsan Region (1962), Kobayashi (1966), Cheong, C.H. (1969) and Kim, O.J. et al. (1973). Kobayashi studied megafossils such as trilobites, brachiopods and others collected from the formation and divided it into five fossil zones on the basis of the megafossils;

- (1) *Prochuangia* Zone, (2) *Chuangia* Zone,
- (3) *Kaolishania* Zone, (4) *Dictyites* Zone,
- (5) *Eoorthis* Zone in ascending order.

As the result of this work he correlated the formation with the late Cambrian Chaumitian Series of North China.

The Machari Formation was initially named by Yoshimura (1940) for the early Paleozoic strata distributed in Macha-Ri district, which is located at about 10km north of Yeongweol. The Formation is well exposed in the type locality, Macha-Ri area, and crops out also in the western and southern part of Yeongweol-Gun. It consists chiefly of bluish grey tabular limestones alternated with thinly bedded dark grey slates and shales, showing banded structures. The formation is underlain by the Wagok Formation (Yoshimura, 1940) conformably, but the relationship

with the lower formation has been less clarified.

Kobayashi (1953, 1966a) stated that the formation overlies the Sambangsan Formation with conformity, whereas the Geological Investigation Corps of Taebaegsan Region (1962) indicated that the boundary between the Machari and the Sambangsan Formation is not in normal conformable relation, but the latter may be later in age rather than the former. The Machari Formation was studied stratigraphically by Hukasawa (1943), Kobayashi (1953, 1966), the Geological Investigation Corps of Taebaegsan Region (1962) and Kim, Ok Joon et al. (1973). Kobayashi (1935a) studied megafossils collected from this formation and divided it into five fossil zones: (1) *Olenoides* Zone (2) *Tonkinella* Zone (3) *Eochuangia* Zone (4) *Komaspis-Koptura-Iwayaspis* Zone and (5) *Olenus-Glyptagnostus* Zone in ascending order, and he concluded that the formation is dated from Middle to early Late Cambrian in age. In consideration of the stratigraphic work with conodont study, however, Kim, O. J. et al. (1973) expressed that the Machari Formation may be Upper Cambrian in stratigraphic level.

### 4. COLLECTING LOCALITIES

For this conodont study 17 samples were collected from the above described formations distributed in Samcheok and Yeongweol-Gun, Kangweon-Do, South Korea. Text-fig. 1 shows the sample localities and the sampling points in both regions. The sampling localities and the lithologic characters of the samples are as follows.

Locality 1 ; Dongjeom-Ri, Sangjang-Myeon, Samcheok-Gun, Kangweon-Do, South Korea.

4 Samples were collected by Mr. Jong Deock Lee at intervals of about 40—50 m from the Hwajeol Formation cropping out along the cliffs located at the eastern side of Dongjeom rail station.

Sample No. 2. Pale grey, pinkish massive limestone. It yielded some conodonts.

Sample No. 3. Pinkish grey vermicular massive limestone, no conodont has been found.

Sample No. 4. Pale grey vermicular, massive limestone, no conodont.

Sample No. 5. Light grey vermicular massive limestone, no conodont.

Locality 2; Macha-Ri district, Bug-Myeon, Yeongweol-Gun, Kangweon-Do, South Korea.

The writer, with the assistance of several senior students, collected 10 samples from a section of the Machari Formation which is exposed along the road between Omandong and Migiri, using the serial sampling method. Three other samples were obtained by the writer from the same formation, cropping out at Solchi-ri, 8 km north of the village of Macha-Ri.

Sample No. 40. Dark grey massive limestone with alternating shales. No conodont has been found.

Sample No. 41. Light grey massive dolomitic limestone, no conodont.

Sample No. 42. Dark grey massive limestone, no conodont.

Sample No. 48. Dark grey massive limestone, no conodont.

Sample No. 49. Grey massive limestone, some conodont has been found.

Sample No. 50. Dark grey dolomitic limestone, no conodont.

Sample No. 53. Dark grey microcrystalline limestone, some conodonts have been found.

Sample No. 54. Grey and light grey microcrystalline dolomitic limestone, no conodont.

Sample No. 55. Dark grey microcrystalline limestone, no conodont.

Sample No. 56. Dark grey thinly bedded limestone, no conodont.

Sample No. 57. Grey massive limestone, no conodont.

Sample No. 58. Dark grey microcrystalline

limestone, no conodont.

Sample No. 59. Dark grey microcrystalline limestone, no conodont.

### 5. CONODONT FAUNAS AND THEIR BIOSTRATIGRAPHY

The conodont species obtained from the two formations, the Hwajeol and the Machari, and their distribution within the formations are presented in Table 1.

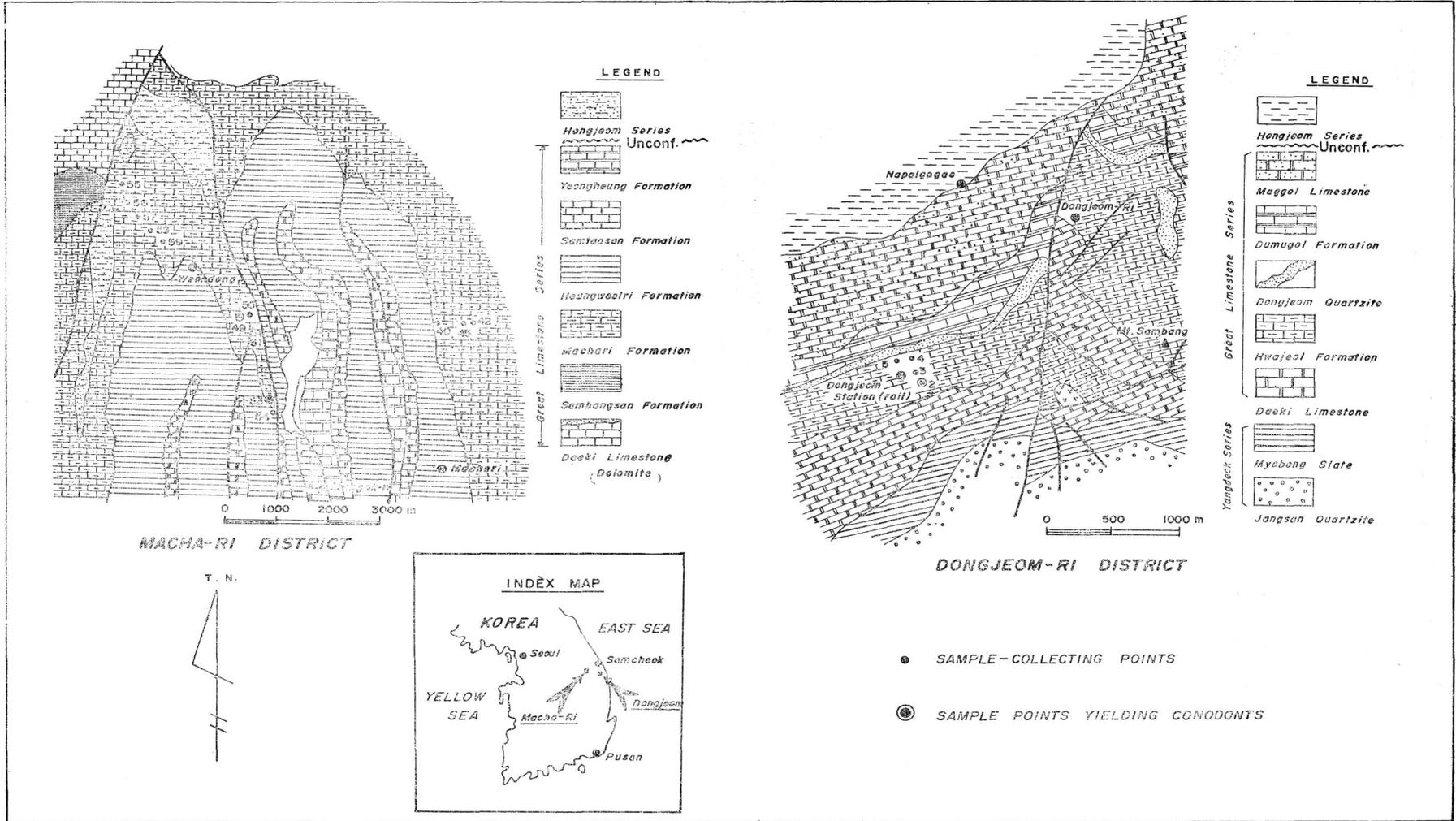
#### 1) The Hwajeol Fauna

Only one of 4 samples collected from the Hwajeol Formation yielded conodonts, which are assigned to 4 form species referable to 3 form genera (see Table 1).

Of these species *Oneotodus nakamurai* Nogami, which is distinguished from other similar Cambrian conodonts by the presence of white matter in the cone, was initially known from the Upper Cambrian Yencho Formation in China (Nogami, 1967). Recently it has been suggested, however, that its stratigraphic range may be extended to somewhat higher level, that is, to the lowermost Ordovician (Miller, 1969; Druce & Jones, 1971 and Jones, 1971). On the other hand the species *Proconodontus tricarinatus* Nogami has been reported hitherto as coming from the Upper Cambrian strata. The species originally was found from the Upper Cambrian Kushan Formation in China (Nogami, 1966) and later also from the synchronous Yencho Formation in China (Nogami, 1967), Australia (Druce & Jones,

form-species	formation	Machari Formation		Total
	sample number	Hwajeol Formation	53	
<i>Furnishina asymmetrica</i> Müller		2		2
<i>F.</i> sp. cf. <i>F. furnishi</i> Müller		5		5
<i>Hertzina?</i> <i>bisulcata</i> Müller		1		1
<i>Oneotodus nakamurai</i> Nogami	9			9
<i>Proconodontus tricarinatus</i> (Nogami)	7		4	11
<i>Prooneotodus gallatini</i> (Miller)	3			3
<i>P.</i> <i>rotundatus</i> (Druce & Jones)			3	3
<i>P.</i> <i>tenuis</i> (Miller)	3	2	56	61
Total	22	2	71	95

Table 1 The represented conodonts and their distribution in two formations.



Text-fig. 1 Index Map showing the sampling localities with sampling points. (Geologic map after KIM OK JOON et al. 1973)

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## CONODONTS FROM THE UPPER CAMBRIAN FORMATIONS, SOUTH KOREA

1971; Jones, 1971) and Iran (Müller, 1973).

The species *Prooneotodus gallatini* (Müller) were first described from the Upper Cambrian in North America and in Sweden (Müller, 1959) and has been further found from the Yencho Formation in China (Nogami, 1967), the Notch Peak Limestone in North America (Miller, 1969) and the Chatsworth Limestone and the Gola Beds in Australia (Druce and Jones, 1971), whose stratigraphic ranges fall within the Upper Cambrian Period.

The lightly identifiable, long and slender species, *Prooneotodus tenuis* (Müller) is one of the somewhat long-ranging forms and has been reported from the Middle to Upper Cambrian strata in Sweden (Müller, 1959), North America (Müller, 1959; Clark & Robinson, 1969; Miller, 1969), China (Nogami, 1966), Australia (Druce & Jones, 1971) and Iran (Müller, 1973).

In consideration of this stratigraphic distribution of the Hwajeol conodonts, it is suggested that the fauna may be dated to late Cambrian in age, because the mutual occurrence of the above mentioned four species is possible in the stratigraphic level equivalent to Upper Cambrian. This age determination agrees with the previous attempt of the stratigraphic correlation based on the study of megafossils (Kobayashi, 1966).

### 2) The Machari Fauna

Only two of 13 samples collected from the Machari Formation yielded conodonts and they are assigned to 6 form species referable to 4 form genera as shown at Table 1.

Of these species *Proconodontus tricarinatus* (Nogami) and *Prooneotodus tenuis* (Müller) are common species with those of the Hwajeol Formation and their stratigraphic ranges were commented in the previous paragraph.

The species *Furnishina asymmetrica* Müller

has been known, hitherto, from Middle to Upper Cambrian in Sweden (Müller, 1959), North America (Müller, 1959; Clark & Robinson, 1969), China (Nogami, 1966) and Iran (Müller, 1973). The species *Hertzina bisulcata* Müller which is represented by only a single specimen from the Machari fauna, appears to be one of the oldest conodonts and has been described mostly from Middle Cambrian in Sweden (Müller, 1959), Denmark (Polson, 1966) and North America (Clark and Robinson, 1969). Müller (1971, Table 1) suggested, however, that the species may be extended to the lower part of the Upper Cambrian Period.

The species *Prooneotodus rotundatus* (Druce & Jones) has been reported from the Upper Cambrian of Australia (Druce & Jones, 1971; Jones, 1971), and Müller (1973) described a form compared to the species from the lowermost Ordovician in Iran (Assemblage Zone 7).

The species *Furnishina furnishi* Müller with which one of the species represented may be conspecific, has been known mostly from the Upper Cambrian in Sweden (Müller, 1959), North America (Müller, 1959; Clark & Robinson, 1969; Miller, 1969), China (Nogami, 1966) and Iran (Müller, 1973).

The stratigraphic distribution of the represented conodonts suggests, therefore, that the Machari fauna may be also dated to the Upper Cambrian. This indication generally agrees with the previously attempted age determination based on the study of megafossils (Kobayashi, 1966) except for its lower limit. The dating by megafossils indicated that the lower part of the Machari Formation is lowered to the Middle Cambrian in age. However, it needs more detailed work based on sufficient conodont materials for the confirmable age determination.

## SYSTEMATIC DESCRIPTION

### Genus *Furnishina* Müller, 1959

#### Type species-*Furnishina furnishi* Müller, 1959

#### *Furnishina asymmetrica* Müller, 1959

Pl.1, Fig.1, Text-fig. 2-A

1959 *Furnishina asymmetrica* Müller, Z. deutsch. geol. Ges., 111 : 451, Pl.11, Figs. 16, 19.

1966 *Furnishina asymmetrica*-Nogami, College of Sci., Kyoto Univ. Mem., Ser. B.32 : 354, Pl.9, Figs.1, 2.

- 1969 *Furnishina asymmetrica*-Clark and Robinson, Jour. Paleont., 43 : 1045.  
 1971 *Furnishina asymmetrica*-Müller, Geol. Soc. Amer. Mem., 127 : 17, Fig.1-6.  
 1973 *Furnishina asymmetrica*-Müller, Geol. Surv. Iran, Report, 30 : 39, Pl.1, Figs.6, 8, 9.

Description: Unit simple, with highly expanded basal sheath. Cusp nearly erect, flattened anteriorly with sharply edged antero-lateral costae. Posterior margin sharply keeled by median posterior edge, accompanying postero-lateral grooves. Cross section shaped triangularly above mid-height of cone.

Base highly expanded posteriorly and extended downwards antero-basally. Oral margin sharply edged at nearly a right angle curvature with

posterior edge of cusp. Basal cavity deeply excavated. Unit thin walled in overall.

Remarks: The Korean specimens agree fundamentally with the illustration and description of the original specimens (Müller, 1959). The base is, however, more extended antero-basally than the latter's.

Occurrence: Machari Formation (Sample No.53).

Materials: 2 specimens.

***Furnishina* sp. cf. *F. furnishi* Müller, 1959**

Pl.1, Fig.5, Text-fig. 2-H

- 1959 *Furnishina furnishi* Müller, Z. deutsch. geol. Ges., 111 : 452. Pl.11, Figs.5,6,8,9,11-15,17,18(?); Pl.12, Figs.1,6, Text-fig. 6 D.E.  
 1966 *Furnishina furnishi*-Nogami, College of Sci., Kyoto Univ. Mem., Ser. B,32 : 354-355, Pl.9, Figs.5-7.  
 1969 *Furnishina furnishi*-Müller, Jour. Paleont., 43 : 430.  
 1969 *Furnishina furnishi*-Clark and Robinson, Jour. Paleont., 43 : 1045.  
 1971 *Sagittodontus furnishi*-Druce and Jones, Bur. Miner. Resour. Aust. Bull., 110 : 87-88, Pl.9, Figs. 1a-4c, Text-fig. 28c,d.  
 1971 *Furnishina furnishi*-Müller, Geol. Soc. Amer. Mem., 127 : 12,13, Pl.1, Figs. 9,12,14,15.  
 1973 *Furnishina furnishi*-Müller, Geol. Surv. Iran, Report, 30 : 39, Pl.1, Figs.4, 5a,b,7,10.

Description: Unit simple and nearly erect, narrowing gradually towards the apex. Cusp flattened or slightly rounded anteriorly with antero-lateral costae on each side and sharply edged posteriorly. Both lateral faces equally flattened with cross section of a triangular form, indicating characteristic feature of the genus *Furnishina*. Basal sheath thin-walled and slightly expanded

posteriorly. Basal cavity deeply excavated.

Remarks: The represented specimens may be compared with the species *Furnishina furnishi*, particularly with those forms illustrated by Müller (1959) as Figs. 9 and 18 in Plate 11.

Occurrence: Machari Formation (Sample No.53).

Materials: 5 specimens.

**Genus *Hertzina* Müller, 1959**

**Type species-*Hertzina americana* Müller, 1959**

***Hertzina?* *bisulcata* Müller, 1959**

Pl.1, Fig.3, Text-fig. 2-C

- 1959 *Hertzina? bisulcata* Müller, Z. deutsch. geol. Ges., 111 : 456, Pl.13, Figs.22-24,27.  
 1969 *Hertzina bisulcata*-Clark and Robinson, Jour. Paleont., 43 : 1045, Text-fig. 1,d.  
 1971 *Hertzina bisulcata*-Müller, Geol. Soc. Amer. Mem., 127 : 12,13, Tab.1.

Description: Unit simple, slender, cone-like form without any distinct curvature of discrimination between basal sheath and cusp. Cusp rounded anteriorly, and bluntly edged or slightly rounded posteriorly. Both lateral faces nearly flattened with longitudinal narrow grooves on their anterior parts. Basal cavity deeply excavated with its

apex near distal part of unit. Thinly walled in the whole surface of cone.

Remarks: The single specimen at hand agrees fundamentally with the original description and illustrations of the species *H.? bisulcata* Müller through its lateral grooves and the cross-section of the cusp. The posterior side is, how-

ever, more narrowly edged in the represented specimen than in the original. The Korean specimen shows a transitional feature between

*Hertzina* and *Furnishina*.

Occurrence: Machari Formation (Sample No.53).

Materials: 1 specimen.

**Genus *Oneotodus* Lindström, 1955**

**Type species-*Distacodus? simplex* Furnish, 1938**

***Oneotodus nakamurai* Nogami, 1967**

Pl.1, Fig.6, 9, 10, Text-fig. 2-E, G

1967 *Oneotodus nakamurai* Nogami, College of Sci, Univ. Kyoto, Mem., Ser. B, 33 : 216, Pl. 1, Figs.9-13.

1969 *Oneotodus nakamurai*-Miller, Jour. Paleont., 43 : 435-436, Pl.63, Figs.1-3, 5-9, Text-fig. 5E.

1971 *Oneotodus nakamurai*-Druce and Jones, Bur. Miner. Resour. Aust. Bull., 110 : 82-83, Pl. 10, Figs. 1-8b, Text-fig.26 I.J.

1971 *Oneotodus nakamurai*-Jones, *ibid.*, 117,58, Pl.4, Figs. 1a-4c.

1971 *Oneotodus nakamurai*-Jones, Shergold and Druce, Jour. Geol. Soc. Aust. 18 : 18, Text-fig. 6.

1971 *Oneotodus nakamurai*-Müller, Geol. Soc. Amer. Mem., 127 : 17, Text-fig. 1-e.

1971 *Oneotodus nakamurai*-Müller, Fac. Sci., Kyoto Univ., Mem. Ser. Geol. Min., 38 : Pl. 7, Fig.1.

1973 *Oneotodus nakamurai*-Müller, Geol. Surv. Iran, Report, 30 : 41, Pl.5, Fig.4.

Remarks: The species is characterized by the existence of white matter in cusp. The Korean specimens agree well with the original form in this feature, but they are more variable in shape of the cross section, whose forms range from circular to antero-posteriorly bluntly edged form.

The basal cavity in the Korean specimens also is not constant, and the apex of the deepest basal cavity reaches nearly mid height of the cone.

Occurrence: Hwajeol Formation (Sample No.2).

Materials: 9 specimens.

**Genus *Proconodontus* Miller, 1969**

**Type species-*Proconodontus tricarinatus* (Nogami, 1967)**

Pl.1, Fig.4, 8, Text-fig. 2-D

1967 *Hertzina* (?) *tricarinata* Nogami, College of Sci., Kyoto Univ. Mem., Ser. B, 33 : 214-215, Pl.6, Figs. 5-8.

1967 *Acodus cambricus*-Nogami, *ibid.*, 213, Pl.1, Figs. 1-4.

1971 *Coelocerodontus tricarinatus*-Druce and Jones, Bur. Miner. Resour. Aust. Bull., 110 : 63, Pl.11, Figs.1a-4c.

1971 *Coelocerodontus tricarinatus*-Jones, Shergold and Druce, Jour. Geol. Soc. Aust., 18 : 18, Text-fig.6.

1973 *Proconodontus tricarinatus*-Müller, Geol. Surv. Iran, Report, 30 : 44, Pl. 3, Fig.9.

Remarks: The species is characterized by the corrugated lateral faces with one or two broadly rounded costae (Druce and Jones, 1971). Druce and Jones (1971) suggested that *Acodus cambricus* Nogami is conspecific with this species. In the represented Korean specimens both forms

are found together and in this work they are identified as conspecific like Druce & Jones' opinion.

Occurrence: Hwajeol Formation (Sample No.2).

Machari Formation (Sample No.53).

Materials: 11 specimens.

**Genus *Prooneotodus* Müller & Nogami, 1971**

**Type species-*Oneotodus gallatini* Müller, 1959**

***Prooneotodus gallatini* (Müller, 1959)**

Pl.1, Fig.2, 12, Text-fig. 2-B,J

1959 *Oneotodus gallatini* Müller, Z. deutsch. geol. Ges., 111 : 457, Pl.13, Figs.5,6,8-10,18.

1969 ? *Oneotodus gallatini*-Miller, Jour. Paleont. 43 : 435.

- 1971 *Oneotodus gallatini*-Druce and Jones, Bur. Miner. Resour. Aust. Bull., 110 : 81, Pl.9, Figs. 9a-c, Pl.10, Figs. 9a-10c, Text-figs. 26 f,g.  
 1971 *Oneotodus gallatini*-Jones, Shergold and Druce, Jour. Geol. Soc. Aust., 18:18, Text-fig.6.  
 1971 *Oneotodus gallatini*-Müller, Geol. Soc. Amer. Mem., 127 : 14, Tab.1.

Description: Unit simple, hollow cone with very thin wall. Cusp moderately recurved above mid-height of cone with circular cross section. Surface of cusp smooth.

Basal sheath fairly expanded posteriorly with oval-shaped aboral outline. Basal cavity deeply excavated with apex reaching distal part of cusp.

Remarks: The Korean specimens at hand are well in agreement with the original description

and illustration of the species (Müller, 1959). The species *Prooneotodus gallatini* (Müller) is similar to *Proconodontus rotundatus* (Druce & Jones) in the circular cross section of cone but the former differs from the latter through the posteriorly more expanded basal sheath.

Occurrence: Hwajeol Formation (Sample No.2).  
 Materials: 3 specimens.

### ***Prooneotodus rotundatus* (Druce & Jones, 1971)**

Pl.1, Fig.7, 11, 13, Text-fig. 2-F,I

- 1971 *Coelocerodontus rotundatus* Druce & Jones, Bur. Miner. Resour. Aust. Bull., 110 : 62-63, Pl.9, Figs. 10a-13b, Text-fig.22c,d.  
 1971 *Coelocerodontus rotundatus*-Jones, ibid., 117, Pl. 1, Figs. 1a-c.  
 1971 *Coelocerodontus rotundatus*-Jones, Shergold and Druce, Jour. Geol. Soc. Aust., 18 : 18-19, Text-fig.6.  
 1973 *Proconodontus* cf. *rotundatus*-Miller, Geol. Surv. Iran, Report, 30 : 43, Pl.3, Figs. 1a-b, 3a-c.

Remarks: The species is characterized by the simple thin-walled cone with a circular cross section through the length. The Korean specimens at hand are fairly uniform to this character, the cusp is, however, somewhat more erected than the Australian specimens.

Müller (1973) rearranged this species into *Proconodontus* Miller. According to the definition of the genus *Proconodontus*, however, it is lat-

erally compressed and antero-posteriorly keeled, whereas Druce and Jones (1971) noticed that the species *Coelocerodontus rotundatus* has a circular cross section without any keel. Therefore, this species should be placed in the genus *Prooneotodus* (Müller & Nogami)

Occurrence: Machari Formation (Sample No.53.)

Materials: 3 specimens.

### ***Prooneotodus tenuis* (Müller, 1959)**

Pl.1, Fig.14-17, Text-fig. 2-K,L

- 1959 *Oneotodus tenuis* Müller, Z. deutsch. geol. Ges., 111 : 457, Pl.13, Figs. 11,13,14,20.  
 1966 *Oneotodus tenuis*-Nogami, College of Sci., Univ. Kyoto, Mem., Ser. B., 32 : 356, Pl.9, Figs.11,12.  
 1969 *Oneotodus tenuis*-Clark and Robinson, Jour. Paleont., 43 : 1045, Text-fig. 1a.  
 1971 *Oneotodus tenuis*-Druce and Jones, Bur. Miner. Resour. Aust. Bull., 110 : 83.  
 1971 *Oneotodus tenuis*-Müller, Geol. Soc. Amer. Mem., 127 : 8, Pl.1, Figs.1,4-6.  
 1971 *Oneotodus tenuis*-Jones, Shergold and Druce, Jour. Geol. Soc. Aust., 18 : 18, Text-fig.6.  
 1973 *Prooneotodus tenuis*-Müller, Geol. Surv. Iran, Report, 30 : 45, Pl.1, Figs.1-3a,b.

Remarks: The species is characterized by a very slender, long cone with oval shaped cross section. The Korean specimens are well in agreement with the illustration and the description of the original specimens (Müller, 1959). As noted by Müller (1959, p.457) many Korean specimens have a sharp edge on the posterior side of the

cone, particularly on the lower part of cone. The species is the most abundant of the represented species.

Occurrence: Hwajeol Formation (Sample No.2).  
 Machari Formation (Sample No.49, 53).

Materials: 61 specimens.

南韓, 江原道地域의 上部캠브리아系에서 產出된 코노돈트 化石群

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<要 約>

南韓 江原道 三陟郡 上長面 銅店里와 寧越郡 北面 磨磨里부근에 分布된 大石灰岩統의 花折層과 磨磨里層에서 鑑別可能한 95個의 코노돈트 化石이 產出되었으며 이들은 5屬 8種으로 分類된다.

花折層에서 產出된 코노돈트는 3屬 4種이며 이들은 이미 알려진 北美, 유럽, 오스트렐리아 및 中國의 初期 古生系에서 產出된 코노돈트화석군과 대비할 때 上部캠브리아系의 化石群임을 指示하고 있다. 磨磨里層에서는 4屬 6種의 코노돈트가 產出되었고 이들은 이미 알려진 코노돈트化石群과의 層序對比에 의하면 대체로 上部캠브리아系의 化石群이다. 이와 같은 兩化石群의 生層序對比는 上記 兩層에서 產出된 다른 化石(小林貞一, 1966)에 의한 時代決定과 대체로 一致한다. 그러나 보다 正確한 層序對比에는 더 많은 個體와 더 많은 種類의 코노돈트 화석이 요구된다. 花折層과 磨磨里層에서 產出된 코노돈트化石群과 그의 產出分布는 本文의 Table 1 과 같다.

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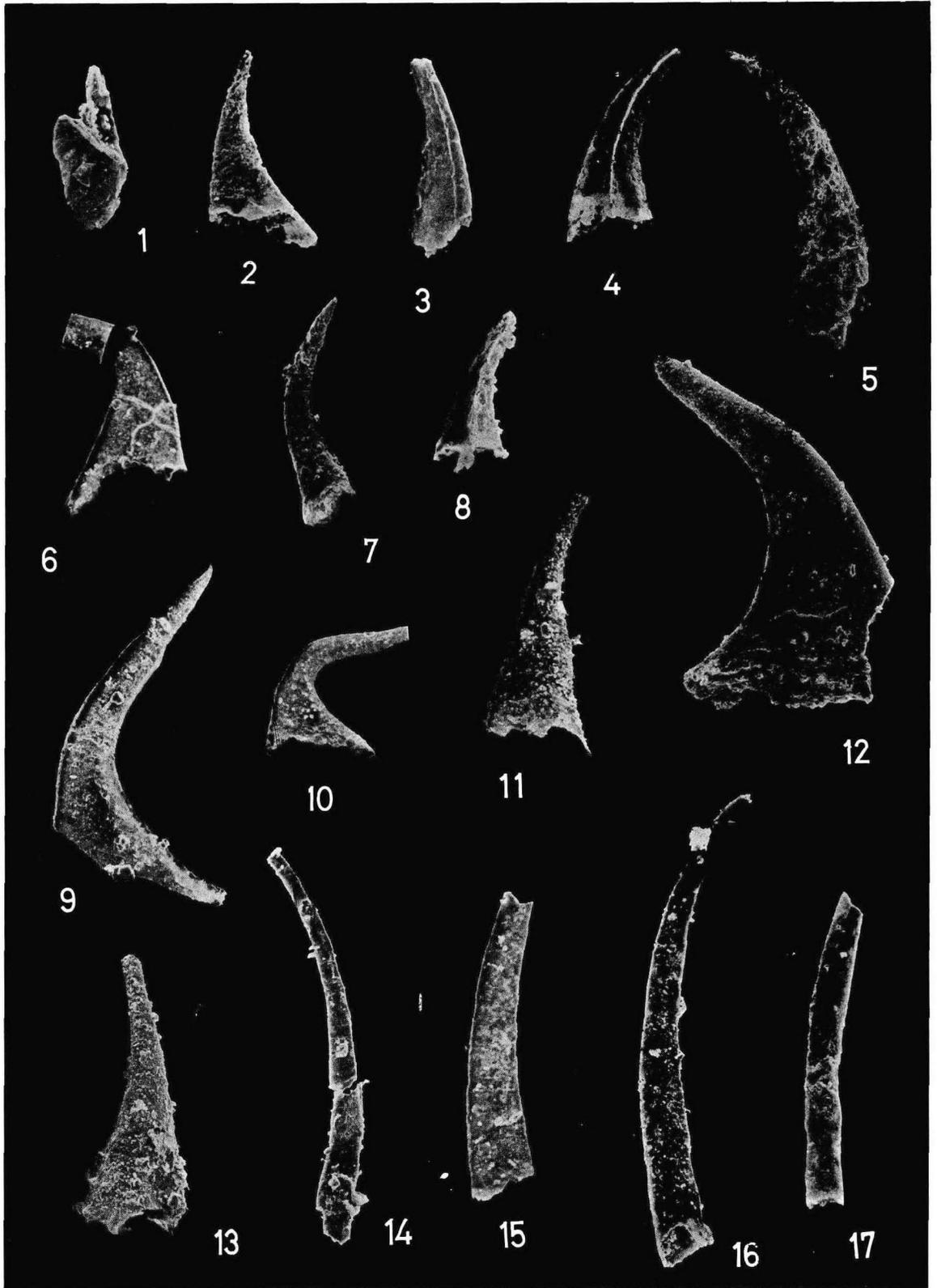
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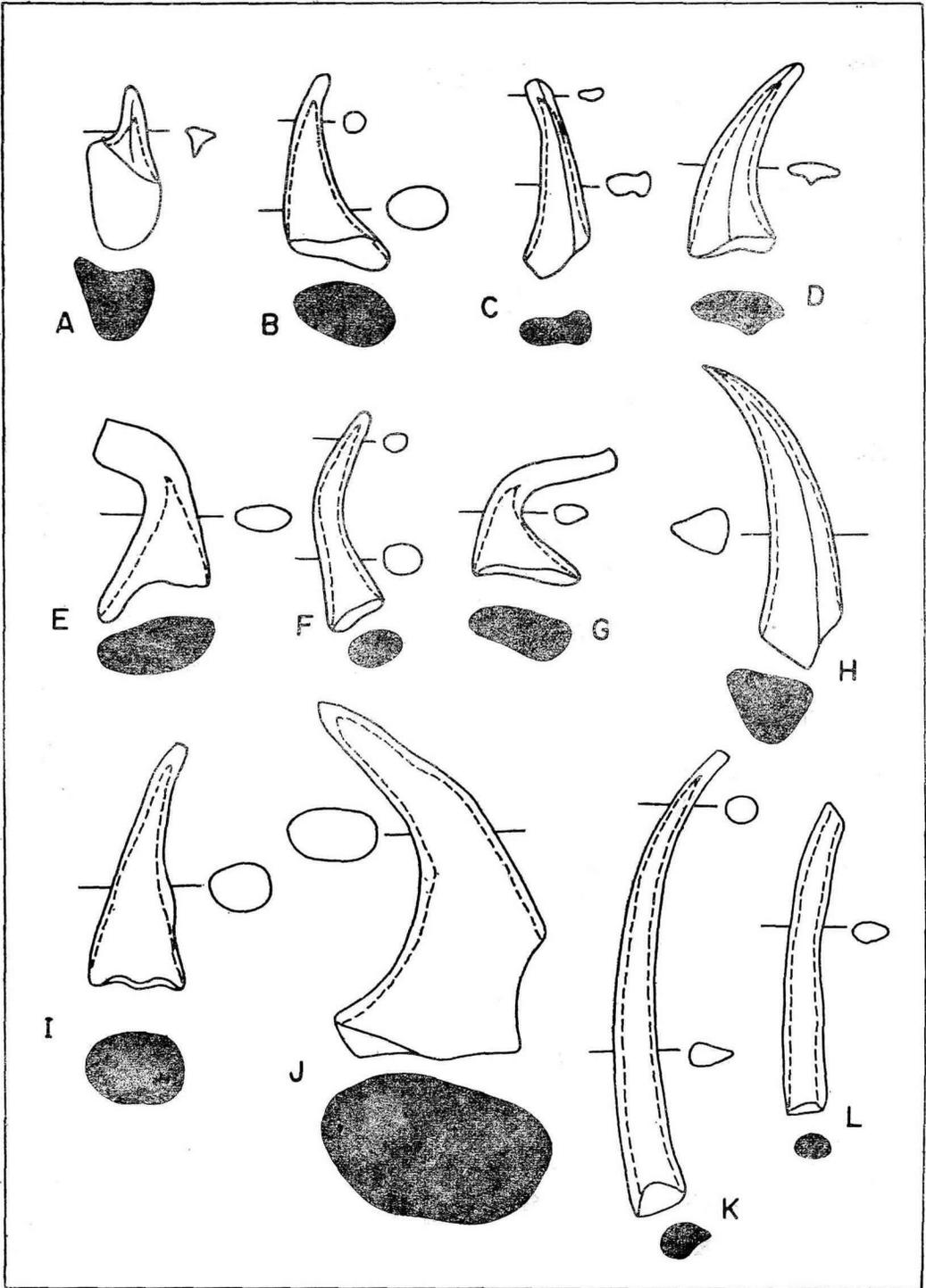
## EXPLANATION OF PLATE I

All figures x90. YSUG means that the illustrated specimens are deposited in Department of Geology, Yonsei University, Seoul, Korea.

- Fig. 1. *Furnishina asymmetrica* Müller, 1959  
Postero-lateral side. YSUG 00068, Sample no.53.  
Machari Formation, North-western side of Omandong, Bug-Myeon, Yeongweol-Gun.
- Fig. 2, 12. *Prooneotodus gallatini* (Müller, 1959)  
Lateral sides. Fig. 2: YSUG 00069, Fig.12: YSUG 00070, Sample no.2  
Hwajeol Formation, Dongjeom-Ri, Sangjang-Myeon, Samcheok-Gun.
- Fig. 3. *Hertzina? bisulcata* Müller, 1959  
Lateral side. YSUG 00071, Sample no.53  
Formation and Locality, the same as Fig.1
- Fig. 4, 8. *Proconodontus tricarinatus* (Nogami, 1967)  
Lateral sides. Fig. 4: YSUG 00072, Sample no.2 Fig. 8: YSUG 00073, Sample No.53  
Fig. 4: Formation and Locality, the same as Fig. 2  
Fig. 8: Formation and Locality, the same as Fig. 1
- Fig. 5. *Furnishina* sp. cf. *F. furnishi* Müller, 1959  
Lateral side. YSUG 00074, Sample no.53  
Formation and Locality, the same as Fig. 1
- Fig. 6,9,10. *Oneotodus nakamurai* Nogami, 1967  
Lateral sides. Fig. 6: YSUG 00075, Fig. 9: YSUG 00076, Fig. 10: YSUG 00077  
Sample no.2, Formation and Locality, the same as Fig. 2
- Fig. 7,11,13. *Prooneotodus rotundatus* (Druce & Jones, 1971)  
Lateral sides. Fig. 7: YSUG 00078, Fig.11: YSUG 00079, Fig.13: YSUG 00080, Sample no.53  
Formation and Locality, the same as Fig.1
- Fig.14-17. *Prooneotodus tenuis* (Müller, 1959)  
Lateral sides. Fig.14: YSUG 00081, Sample no.53, Fig.15: YSUG 00082, Sample no.2  
Fig.16: YSUG 00083, Sample no.49. Fig.17: YSUG 00084, Sample no.53  
Formation and Locality of Fig.14 and 17, the same as Fig. 1. Formation and Locality of Fig.15, the same as Fig.2. Fig.16: Machari Formation, West side of Yeonpyeong-Dong, Bug-Myeon, Yeongweol-Gun.



공 백



Text-fig. 2. Illustrated figures showing the shape of cross section and the aboral outline of cones.