

REVISION AND ADDITION ON THE CAMBRIAN MICROFAUNA FROM THE KURANGNI AREA, MUNGYEONG - GUN, GYEONGSANGBUK - DO, SOUTH KOREA

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ABSTRACT

Additional small shelly fossils were recovered from the Cambrian limestone beds distributed in Kurangni of Mungyeong area, Gyeongsangbuk - do. Eleven out of fourteen collected samples yielded 407 specimens of microfossils, which were differentiated into eight species representing seven genera. The fossil assemblage was correlated with those of relevant Early Cambrian strata in China, and compared with the previously studied domestic strata such as the Sambangsan, Myobong, and Daegi formations. *Hyolithellus* cf. *decorus*, *Allonnia* cf. *erromenosa*, and *Nanjiangofolliculus* aff. *cyclicus* are newly described in Mungyeong area. The age of the recovered microfauna is thoroughly discussed. This investigation revises the previous interpretation on the limestone beds in the study area, and suggested the beds be contemporaneous or even younger than the Lower Cambrian Kurangni Formation.

Key words : Mungyeong, Cambrian, Small shelly fossils.

INTRODUCTION

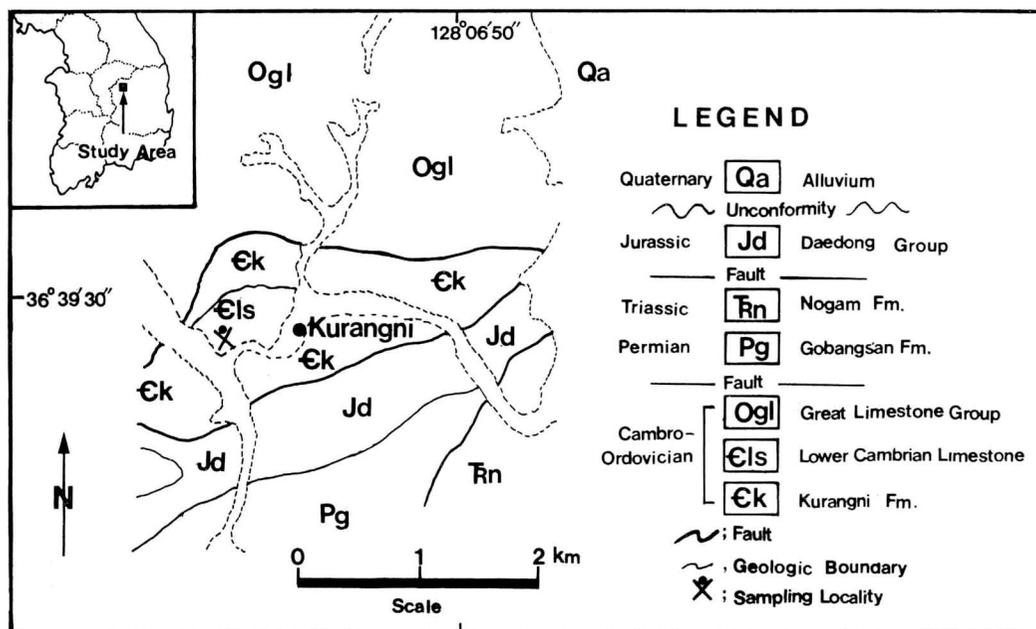
The lower Paleozoic Choseon Supergroup is distributed in Myungyeong - gun, Gyeongsangbuk - do. The sequence is exposed chiefly in the eastern and western sides of the Mungyeong Coal Field which comprises the upper Paleozoic Pyeongan and the Jurassic Daedong Group in the center.

The lower Paleozoic Choseon Supergroup in the west (Maseong - Gaeun area) has been studied by many authors (Table 1). Aoti (1942) divided the sequence into six lithostratigraphic units, which are Kurangni Formation, Hyungang Formation (later renamed to Maseong Formation by Kobayashi, 1953), Hanaeri Formation, Sokgyori Formation, Joengri Formation, and Dodam Formation in ascending order. All but the Kurangni Formation are composed chiefly of limestones with thinly intercalated shales. Subsequent authors unified upper five units into an unclassified Great Limestone Group, due to the ambiguity of the boundaries of the units. Samples for the present study were collected from the lowermost portion of the Maseong Formation of Kobayashi (1953). The formation is considered to represent the lowermost part of the Great Limestone Group or the strata just above the conventional Kurangni Formation. The sampling locality is shown in Text - fig. 1.

Kobayashi (1958, 1961, & 1966) described a number of invertebrate fossil taxa such as trilobites, brachiopods, and gastropods from the lower Paleozoic strata in this area. Lee, D. Y.

& Lee, H. Y. (1985) systematically described and illustrated the trilobite species *Redlichia nobilis* from the Kurangni Formation distributed in the study area. Lee, H. Y. (1987) conducted the first micropaleontological study and reported the Early Cambrian small shelly fauna from the limestone beds of the lower Paleozoic sequence in the area.

In the recent times, Cambrian small shelly fossils have been recorded from three separate regions in Korea. The first study of these fossil types were accomplished by Lee, H. Y. *et al.* (1986), who reported the occurrence of hyolithids and other microfossils along with conodonts and brachiopods from the Sambangsan Formation in Yeongweol - Pyeongchang area, and they concluded that the formation is Middle Cambrian in age. The result was confirmed by Lee, B. S. *et al.* (1991). Lee H. Y. (1987) described hyolithid and monoplacophoran taxa along with a new small shelly taxon *Archiasterella quadratina* in the Mungyeong area, and correlated the recovered fauna with the Early Cambrian faunas worldwide. He, however, did not decisively mentioned the stratigraphic relationship of the fossil - yielding strata with the Kurangni Formation, and suggested the possibility that the strata be older than the Kurangni Formation on the basis of the previously known ranges of the small shelly fossils and trilobites. Lately, Lee, H. Y. *et al.* (1992b) studied the microfossils including small shelly fossils, conodonts, trilobites, and brachiopods from the Myobong and Daegi formations in the Baegunsan Syncline area, and determined their ages to be late Early to early Middle Cambrian and middle Middle Cambrian, respectively. Lee, H. Y. *et al.* (1992a) compiled the Camb-



Text - fig. 1. Geology and sampling locality in the study area.

Table 1. Comparison of the stratigraphic divisions of different authors (formations, whose ages are out of the lower Paleozoic time, are designated by parentheses).

PERIOD	EPOCH	Kobatake (1930)	Aoti (1942)	Kobayashi (1935, 1966)	Ku, J.H. (1964)	Kim, N.J. et al. (1967)	Son, C.M. Paik, K.H. (1972)	Park, J.S. (1974)	Um, S.H. et al. (1977)	THIS STUDY						
ORDOVICIAN	LATE	Great Limestone Series	Dodam Formation	Dodam Formation	Great Limestone Series	Bugokri Formation	Great Limestone Series	Great Limestone Series	Great Limestone Group	Great Limestone Group						
	EARLY		Jeongri Formation	Jeongri Formation												
CAMBRIAN	LATE		Seokgyori Formation	Seokgyori Formation							Yangdeok Series	(Hongjeom Formation)	(Bongsaeng Formation)	Kurangni Formation	Kurangni Formation	Kurangni Formation
	MIDDLE		Hanaeri Formation	Hanaeri Formation												
	EARLY	Hyungang Formation	Maseong Formation													
	EARLY	Kurangni Formation	Kurangni Formation													

rian small shelly fossil data accumulated in Korea until then.

The present study aims to describe the microfossils procured from the limestone strata in the west of Mungyeong area, to discuss their biostratigraphic implication, to clarify the stratigraphic relationship of the fossil-yielding strata with the adjacent Kurangni Formation, and to revise the previous interpretation (Lee, H. Y., 1987) conducted in the same area.

SAMPLING LOCALITY AND THE FOSSIL FAUNA

The limestone beds included in the study are surrounded by the Kurangni Formation in horizontal view (Text - fig. 1). The strata are composed of bluish gray limestone interbedded with the thin layers of calcareous or non-calcareous bluish gray shales. Thickness of beds is approximately 100m, and the general attitude of them is N65 - 80E, 60 - 70NW.

Eleven out of foreteen samples derived from two stratigraphic horizons yielded 407 specimens of microfossils. Most of them are small shelly hyolithids. The state of preservation is generally poor and fragmented, probably due to the higher degree of deformation compared to that of fauna derived from the area towards the northeastern part of the Okcheon Zone. Especially cancellorid skeletons composed of spine-shaped elements are highly fragmented and, thus, hardly differentiated even into the generic levels. Specimens are gray in color.

The microfauna was differentiated into eight species representing seven genera (Table 2). *Actinotheca* cf. *doliformis* is the most dominant species throughout the samples. *Conotheca* cf. *obesa*, *Hyolithellus* sp., and *Archiasterella quadratina* occur from almost all samples studied. Four specimens of *Nanjiangofolliculus* aff. *cyclicus* were recovered from a single sample (sample 3079). Compared to the previous study by Lee, H. Y. (1987), which were conducted in

Table 2. Distributions of recovered microfossils in the productive samples.

Taxa \ Sample number	3078	3079	3080	3081	3083	3084	3086	3087	3088	3089	3090	Total
<i>Actinotheca cf. doliformis</i>	9	7	5	12	22	4	3	15	9	8	10	104
<i>Actinotheca cf. mirus</i>		2	4		6	2	3	1				18
<i>Conotheca cf. obesa</i>	2	1	3	6	2	1	1	2	1	1		20
<i>Loculitheca cf. zhinjinensis</i>		3	1	4		1		3	1			15
<i>Hyalithellus cf. decorus</i>		2	4	3	1	2						12
<i>Hyalithellus sp.</i>	2	4	6	7	5	2	2	2		1	2	33
<i>Archiasterella quadratina</i>	6	5	4	7	4	4	2	10	1	2		45
<i>Allonnia cf. erromenosa</i>	7		5	4	2	5	2	1		2		28
<i>Nanjiangofolliculus aff. cyclicus</i>		4										4
Other Mollusc shells			2			1	2	2		5		12
Indet.	18	13	9	11	13	17	5	8	7	5	10	116
Total	44	41	43	54	55	39	22	44	19	24	22	407

the same area but different spots, *Actinotheca cf. doliformis*, *Actinotheca cf. mirus*, *Conotheca cf. obesa*, *Loculitheca cf. zhinjinensis*, and *Archiasterella quadratina* are present in common. *Bucanotheca cf. distensus*, *Conotheca cf. maidipingensis*, *Paragrobopilus sp.*, *Lapworthella ? sp.*, and *Paraceratoconus rudius* were reported by Lee, H. Y. (1987), but not encountered in the present study. *Hyalithellus cf. decorus*, *Allonnia cf. erromenosa*, and *Nanjiangofolliculus aff. cyclicus* are recorded in this area for the first time.

BIOSTRATIGRAPHIC CONSIDERATION

The earliest Cambrian small shelly fossils have been reported from the cliff outcrops of the Aldan and Lena Rivers in the eastern Siberia and lower Paleozoic platform in the eastern European region of old U. S. S. R. in 1960's. Later records include northern Siberia, Mongolia, China, Australia, India, Canada, U. S. A., and Great Britain. These small shelly faunas are most prolific in carbonate facies with some exceptions.

Recently the study on small shelly fossils has been activated, and they have been considered to have great potential in biostratigraphic use in China. These microfossils are very well documented from the Meishucun Stage of Jinning County, Yunnan Province, which was once suggested to be the standard stratotype of PreCambrian–Cambrian boundary strata.

The Mungyeong fauna mainly consists of hyolithids. Although the fauna represents low in diversity and in frequency, it has the characteristic of earliest Cambrian small shelly fauna and shows the similarity to that of China.

The hyolithid species *Actinotheca doliformis* and *Actinotheca mirus* were reported from the Yutaishan Formation in Huanian and Huogia Counties of Anhui Province, China by Xiao & Zhou (1984). *Actinotheca doliformis* was originally described from the Yutaishan Formation, and *Actinotheca mirus* was also reported from the Meishucun Stage originally named as *Paragloborilus mirus* by Qian (1977). Xiao & Zhou (1984) stated that the Yutaishan Formation in Anhui Province was dated to middle Early Cambrian in age on the basis of occurrence of protolenid trilobites. Lee, H. Y. (1987) also reported both species in the Mungyeong area.

Conotheca obesa and *Loculitheca zhinjinensis* were reported from the Early Cambrian in central west and north of Guizhou Province, China by Qian & Yin (1984). *Conotheca obesa* was previously described from the Meishucun Stage by Qian (1978) originally named as *Circotheca obesa*.

Hyolithellus decorus was originally described from the Huangling Anticline of Yichang County, Hubei Province, western China by Chen (1984). He stated the fauna is biostratigraphically correlated with the Meishucun Stage of Yunnan Province and the Maidiping Formation of Sichuan in China, and *Dokidocyathus regularis* fossil assemblage of Tommotian Stage, U. S. S. R (Table 3).

Archiasterella quadratina was originally described by Lee, H. Y. (1987) in the Mungyeong area. Later Lee, H. Y. *et al.* (1992b) reported this species from the Myobong and Daegi formations in the Baegunsan area.

Allonnia erromenosa, characterized by its three radially arranged spicules, was originally described by Jiang (1984b) in Meishucun Stage of Yunnan Province. This species was also reported in Myobong and Daegi formations in Baegunsan area by Lee, H. Y. *et al.* (1992b).

Nanjiangofolliculus cyclicus, which is uncertain in biological affinity, was originally described by Yang & He (1984) from the Dengying Formation of Nanjian in Sichuan of China, which

Table 3. Early Cambrian biozonations in southwest China and Siberia (from Jiang, 1984a).

SOUTHWEST CHINA			SIBERIA			
Age	Stage	Assemblage	Stage	Assemblage	SE	North
Cambrian	Meishucun	<i>Eonovifatus-Sinosachites-Ebianotheca</i>	Tommotian	<i>Dokidocyathus lenaiucs</i>	Pestrotsvei Fm.	Kugdim Fm.
		<i>Paragloboritus-Siphonogonuchites-Lapworthella</i>		<i>Dokidocyathus regularis</i>		
		<i>Anabarites-Circotheca-Protohertzina</i>		<i>Aldanocyathus sunnginucus</i>		
Precambrian	Dengyingxia		Manykaian	<i>Anabarites trisulcatus</i>	Yudomian Fm.	Nemakit Oaldyn
			Yudomian		Kochokon Fm.	

is correlated with the Meishucun Stage.

Considering the species composition of the present fauna, it may be suggested that the Mungyeong fauna closely resembles to those from the middle Early Cambrian Yutaishan Formation in Anhui Province (Xiao & Zhou, 1984) and also from the Early Cambrian of the central west and north Guizhou Province in China. Jiang (1984) recognized three biostratigraphic zones in the Meishucunian type, which is the standard Early Cambrian in China (Table 3). The species *Actinotheca mirus* and *Conotheca obesa* of the Mungyeong fauna were previously reported from the *Paragloborilus* – Siphonogonuchites Zone, which is the middle biostratigraphic zone of the Meishucun Stage.

Recently Qian & Bengtson (1989) thoroughly reviewed the Meishucun fauna and concluded that the Meishucunian succession probably represents the chance preservation of biotic assemblages that are separated by considerable time intervals. This situation is similar to those of corresponding strata in most other parts of the world. Consequently, biostratigraphic correlation based solely on these faunas is likely to have a low level of resolution (Qian & Bengtson, 1989, p. 147). We agree with their opinion. In the previous work from the Mungyeong fauna, Lee, H. Y. (1987) stated that if this conclusion would be correct, the fossil-bearing limestone beds should not be younger than the Kurangni Formation, from which the trilobite *Redlichia nobilis* was reported. According to Xing *et al.* (1984), the *Paragloborilus* – Siphonogonuchites Zone of the Meishucun Stage preceded the appearance of *Redlichia*, the age of the present microfauna, therefore, should not be directly assigned to this zone. Moreover, some taxonomic identities included in the present microfauna (*Archiasterella quadratina*, *Allonnia erromenosa*, and *Nanjiangofolliculus*) show their occurrences in younger assemblages such as the Middle Cambrian Sambangsan, Myobong, and Daegi faunas. Thus we interpret that the small shelly and sclerite fossils from the Mungyeong area probably represent long-ranging stratigraphic intervals, possibly contemporaneous or even younger than the range of *Redlichia nobilis*.

SUMMARY AND CONCLUSIONS

Fourteen samples were collected from the limestone beds horizontally surrounded by the Kurangni Formation distributed in the west of the Mungyeong Coalfield. Eleven of them yielded 407 specimens of microfossils which were differentiated into eight species representing seven genera. The microfauna mainly consists of hyolithids which are represented by their phosphatic microskeletons.

This microfauna is closely correlated with those of Early Cambrian Yutaishan Formation distributed in the Anhui Province of China and strata developed in the Guizhou Province of China. Especially the composition of the present microfauna is quite similar to the characteristic assemblage of *Paragloborilus* – Siphonogonuchites Zone of the Meishucun Stage. Qian & Bengtson (1989, p. 148) expressed that the *Paragloborilus* – Siphonogonuchites assemblage among the three assemblage included in the Meishucun Stage contains most significant number of forms that have scant records outside China and may be largely endemic. The Mungyeong fauna includes *Paragloborilus* (reported by Lee, H. Y., 1987) and *Actinotheca* along with other common species in the Meishucun Stage, so that the Mungyeong fauna has a close kinship with Chinese faunal assemblage. The age of the microfauna from the Mungyeong area is regarded as contemporaneous or younger than the range of *Redlichia nobilis*.

SYSTEMATIC PALEONTOLOGY

Phylum MOLLUSCA

Class HYOLITHA Marek, 1963

Order ORTHOTHECIDA Marek, 1966

Family GLOBORILLIDAE Syssoiev, 1958

Genus *ACTINOTHECA* Xiao & Zhou, 1984**Type species** : *Paragloborilus mirus* Qian, 1977*Actinotheca* cf. *dolioformis* Xiao & Zhou, 1984

Pl. 1, fig. 1-9

1984 *Actinotheca dolioformis* Xiao & Zhou, p.147, pl.1, Figs. 6, 8, 10-21.1987 *Actinotheca* cf. *dolioformis* Xiao & Zhou-Lee, pp.97-98, pl. 1, fig. 1-7, 10.**Description** : See Lee, H. Y. (1987, p.97).

Remarks : The present specimens are basically identical to those of the Yutaishan Formation, China in general morphology. As illustrated in Table 4, however, the specimens of the present study somewhat vary in length/diameter ratio of the transversal furrow portion of the initial part of the unit. Divergence angle varies also reaching even to 6.1° in minimum. Specimens encountered in Lee, H. Y. (1987) are identical to the present specimens.

Occurrence : 3078, 3079, 3080, 3081, 3083, 3084, 3086, 3087, 3088, 3089, 3090.**Material** : 104.

Table 4. Dimensions of each part of the unit. Illustration number, total length and apertural diameter of the shell, height and width of the initial part, and the divergence angle of *Actinotheca* cf. *dolioformis* are figured in order (in mm).

illustration	SHELL		INITIAL PART		
	length	diameter	height	width	divergence
Pl. 1, fig. 1	0.40	0.19	0.04	0.07	6.1°
fig. 2	0.71	0.36	0.06	0.22	9.5°
fig. 3	0.41	0.28	0.03	0.12	7.2°
fig. 4	0.37	0.32	0.05	0.16	20.0°
fig. 5	0.64	0.84	0.07	0.35	11.0°
fig. 6	0.55	0.45	0.03	0.13	10.0°
fig. 7	0.60	0.26	0.04	0.15	11.5°
fig. 8	0.67	0.31	0.07	0.14	8.0°
fig. 9	0.52	0.54	0.09	0.32	9.5°

Actinotheca cf. *mirus* (Qian, 1977) Xiao & Zhou, 1984

Pl. 1, fig. 10-11

1977 *Paragloborilus mirus* Qian, p.257, pl.1, fig. 16-17.1984 *Actinotheca mirus* (Qian, 1977) Xiao & Zhou, p.147, pl. 1, figs 1-5, 7, 9, pl. 2, fig. 9-18.1987 *Actinotheca mirus* (Qian, 1977) Xiao & Zhou-Lee, p.98, pl. 1, fig. 8-9, pl. 2, fig. 2-3.

Description : See Lee, H. Y. (1987, p. 98).

Remarks : This species is distinguished from *A. dolioformis* by its slender and longer shell form. The present specimens agree well with the description of those from the Yutai-shan Formation in China. However, some specimens show much slender in shell outline and low divergence angle of the initial part compared to those described in the Chinese specimens. The length/diameter (slenderness) is even higher in the present specimens than those studied by Lee, H. Y. (1987)

Occurrence : 3079, 3080, 3083, 3084, 3086, 3087.

Material : 18.

Table 5. Dimensions of each part of the unit. Illustration number, total length and apertural diameter of the shell, height and width of the initial part, and the divergence angle of *Actinotheca* cf. *mirus* are figured in order (in mm).

SHELL			INITIAL PART		
illustration	length	diameter	height	width	divergence
Pl. 1, fig. 10	0.85	0.26	0.06	0.26	10.0°
fig. 11	1.48	0.23	0.08	0.17	7.5°

Genus *CONOTHECA* Missarzhevsky, 1969

Type species : *Conotheca mammilata* Missarzhevsky, 1969

Conotheca cf. *obesa* (Qian, 1978) Qian & Yin, 1984
Pl. 1, fig. 13 – 16

1978 *Circotheca obesa* Qian, p. 8, pl. 1, fig. 1 – 2.

1984 *Conotheca obesa* (Qian, 1978) Qian & Yin, p. 95, 97, pl. 1, fig. 7 – 8.

1987 *Conotheca* cf. *obesa* (Qian, 1978) Qian & Yin – Lee, p. 99 – 100, pl. 2, fig. 18 – 19.

Description : See Lee, H. Y. (1987, p. 99).

Remarks : In most of studied specimens, the initial parts are broken away, and the secondary filling prevents the observation of the internal structures. The present specimens are closely similar to the original material of *Conotheca obesa* from the Guizhou Province in China (Qian & Yin, 1984) in having straight, subcylindrical form with circular section. Specimens here have somewhat greater angle in the initial part than those of the Chinese forms.

Occurrence : 3078, 3079, 3080, 3081, 3083, 3084, 3086, 3087, 3088, 3089.

Material : 20.

Genus *LOCULITHECA* Syssoiev, 1969

Type species : *Circotheca anulata* Syssoiev, 1959

Loculitheca cf. *zhinjinensis* Qian & Yin, 1984

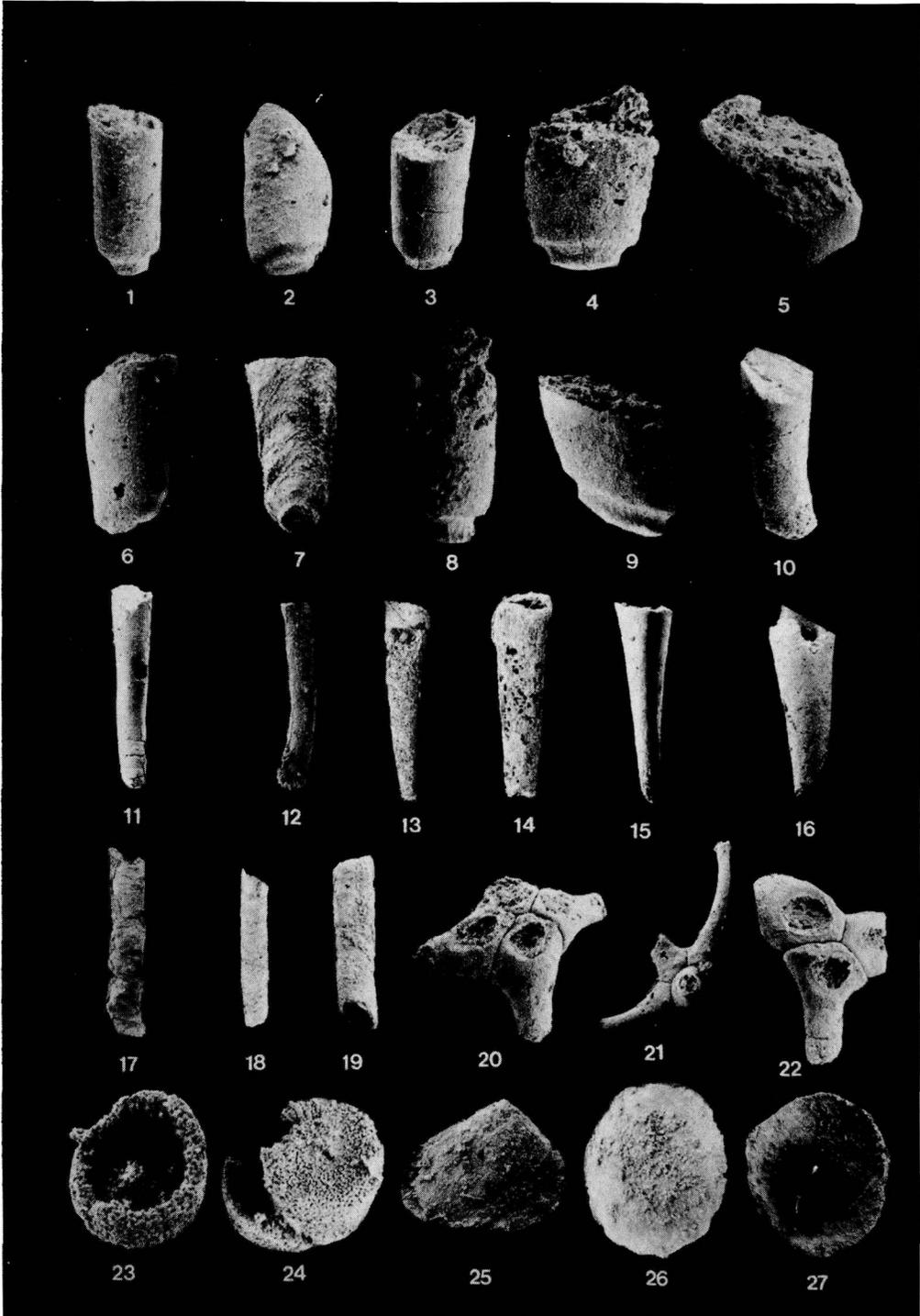
Pl. 1, fig. 12

1984 *Loculitheca zhinjinensis* Qian & Yin, p. 97-98, pl. 1, fig. 12-16, pl. 2, fig. 7.1987 *Loculitheca* cf. *zhinjinensis* Qian & Yin-Lee, p. 101-102, pl. 2, figs. 14-15.**Description** : See Lee, H. Y. (1987, 103).**Remarks** : The present specimens agree with the original description of the species from the lowermost Cambrian strata in Guizhou, China (Qian & Yin, 1984) in general outline of the shell. Owing to the poor preservation of inner structures, the decisive identification is withheld.**Occurrence** : 3079, 3080, 3081, 3084, 3086, 3087, 3088.**Material** : 15.Family *HYOLITHELLIDAE* Walcott, 1886Genus *HYOLITHELLUS* Billings, 1878*Hyolithellus* cf. *decorus* Chen, 1984

Pl. 1, fig. 17

1984 *Hyolithellus decorus* Chen, p. 55-56, pl. 1, fig. 7.**PLATE 1****Fig. 1-9** : *Actinotheca* cf. *dolioformis* Xiao & Zhou, 1984. 1 : lateral view, $\times 100$, sample 3078, YSUG1117, 2 : lateral view, $\times 60$, sample 3078, YSUG1118, 3 : lateral view, $\times 70$, sample 3079, YSUG1119, 4 : lateral view, $\times 110$, sample 3079, YSUG1120, 5 : lateral view, $\times 50$, sample 3080, YSUG1121, 6 : lateral view, $\times 90$, sample 3080, YSUG1122, 7 : lateral view, $\times 80$, sample 3083, YSUG1123, 8 : lateral view, $\times 90$, sample 3083, YSUG1124, 9 : lateral view, $\times 60$, sample 3083, YSUG1125. **Fig. 10-11** : *Actinotheca* cf. *mirus* (Qian, 1977) Xiao & Zhou, 1984. 10 : lateral view, $\times 60$, sample 3080, YSUG1126, 11 : lateral view, $\times 36$, sample 3083, YSUG1127.**Fig. 12** : *Loculitheca* cf. *zhinjinensis* Qian & Yin, 1984, lateral view, $\times 36$, sample 3081, YSUG1128. **Fig. 13-16** : *Conotheca* cf. *obesa* (Qian, 1978) Qian & Yin, 1984. 13 : lateral view, $\times 22$, sample 3080, YSUG1129, 14 : lateral view, $\times 20$, sample 3081, YSUG1130, 15 : lateral view, $\times 47$, sample 3081, YSUG1131, 16 : lateral view, $\times 24$, sample 3087, YSUG1132. **Fig. 17** : *Hyolithellus* cf. *decorus* Chen, 1984, lateral view, $\times 27$, sample 3080, YSUG1133. **Fig. 18-19** : *Hyolithellus* sp. 18 : *Hyolithellus* sp., lateral view, $\times 24$, sample 3080, YSUG1134, 19 : lateral view, $\times 24$, sample 3081, YSUG1135. **Fig. 20-21** : *Archiasterella quadratina* Lee, 1987. 20 : inner view, $\times 50$, 0 sample 3081, YSUG1136, 21 : outer view, $\times 30$, sample 3087, YSUG1137.**Fig. 22** : *Alonnia* cf. *erromenosa* Jiang, 1982, inner view, $\times 65$, sample 3078, YSUG1138. **Fig. 23-24** : *Nanjiangofolliculus* aff. *cyclicus* Yang & He, 1984. 23 : apertural view, $\times 80$, sample 3079, YSUG1139, 24 : basal view, $\times 70$, sample 3079, YSUG1140. **Fig. 25-27** : Other mollusc shells. 25 : upper view, $\times 33$, sample 3079, YSUG1141, 26 : upper view, $\times 37$, sample 3089, YSUG1142, 27 : dorsal view, $\times 36$, sample 3089, YSUG1143.

PLATE 1



Description : Shell small, straight and tubular, aperture slightly oblique. Surface uneven with numerous fine granules arranging in a pattern of network. Cross section circular. Shell wall thick.

Remarks : The present specimens fundamentally agree with those of China in morphology. However, most specimens encountered in the study are fragmented and distorted.

Occurrence : 3079, 3080, 3081, 3083, 3084.

Material : 12.

Hyolithellus sp.

Pl. 1, fig. 18 - 19

Description : Shell uprightly erected, long and slender. The transversal cross section is nearly circular and the plane of aperture is oblique. Shell somewhat thick and has two layers. The surface is finely granulated.

Remarks : The specimens at hand show characteristics of *Hyolithellus* but these are so poorly preserved that precise identification is not possible.

Occurrence : 3078, 3079, 3080, 3081, 3083, 3084, 3086, 3087, 3089, 3090.

Material : 33.

Phylum PORIFERA Grant, 1872

Class and Order Uncertain

Family CHANCELLORIIDAE Walcott, 1920

Genus *ARCHIASTERELLA* Sdzuy, 1969

Type species : *Archiasterella pentactina* Sdzuy, 1969

Archiasterella quadratina Lee, 1987

Pl. 1, fig. 20 - 21

1987 *Archiasterella quadratina* Lee, p. 105, pl. 1, fig. 12.

1992b *Archiasterella quadratina* Lee - Lee *et al.*, pl. 3, fig. 3, 4.

Description : See Lee, H. Y. (1987, p. 105).

Remarks : The specimens encountered in the present study are identical to the original description and illustrations by Lee, H. Y. (1987). The Baegunsan specimens (Lee *et al.*, 1992b) are also identical to the present specimens.

Occurrence : 3078, 3079, 3080, 3081, 3083, 3084, 3086, 3087, 3088, 3089.

Material : 2.

Genus *ALLONNIA* Doré & Reid, 1965

Type species : *Allonnia tripodophora* Doré & Reid, 1965

Allonnia erromenosa Jiang, 1982

Pl. 1, fig. 22

1984b *Allonnia erromenosa* Jiang, p. 22, pl. 4, fig. 12.

1992b *Allonnia erromenosa* Jiang – Lee *et al.*, pl. 3, fig. 1, 2.

Description : Unit consists of three spicules, which lie on same plane and meet each other in their proximal parts making nearly 120°, so that the general outline shows a triangular form in upper view. Each spicule is slender and subsylindrical with subcircular cross section and has one circular groove in inner view. Also, each spicule is tapering distally. The spicule has approximately equal size and contact directly with “Y” shaped contact margin.

Remarks : The present specimens fundamentally agree with those of China and Baegunsan in general morphology.

Occurrence : 3078, 3080, 3081, 3083, 3084, 3087, 3088, 3089.

Material : 28.

INCERTAE SEDIS

Genus *NANJIANGOFOLLICULUS* Yang & He, 1984

Type species : *Nanjiangofolliculus circocodonus* Yang & He, 1984

Nanjiangofolliculus cyclicus Yang & He, 1984

Pl. 1, fig. 23 – 24

1984 *Nanjiangofolliculus cyclicus* Yang & He, p. 43, pl. 3, figs. 6, 7, 16, 17.

Description : Unit is bowl-shaped with thick wall. Lower side is nearly flat and upper side is broadly excavated. Central cavity is large and circular except inflated central part, surface is smooth, although the specimen is considerably recrystallized.

Remarks : The present specimens are similar to those of China, but the specimens here have straight or nearly flat lower side margin and slightly concave upward in the middle part of lower side. Flat lower side distinguishes this species from *Nanjiangofolliculus circocodonus* Yang & He. This distinguishing character may have been a result of their preservational modes. Specimens assigned to this genus in the present study are exclusively *N. cyclicus*, whereas Baegunsan specimens (Lee *et al.*, 1992b) included in the same genus are exclusively *N. circocodonus*.

Occurrence : 3079.

Material : 4.

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경상북도 문경군 구랑리지역에 분포하는 캄브리아기 지층에서 산출된 미화석군에 대한 재고 및 추가

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요 약

경상북도 문경군 구랑리 부근에 분포하는 석회암층에 대해 인회질 미화석연구를 수행하였다. 채취된 14개의 시료중 11개의 시료에서 407개체의 미화석이 추출되었고, 이는 7속 8종의 화석으로 분류되었다. 문경화석군을 상응하는 중국의 제 지층들에서 산출된 화석군과 대비하였으며, 기존의 국내연구(삼방산층, 묘봉층, 대기층등)와 비교하였다. 이 지역에서는 처음으로 *Hyalithellus* cf. *decorus*, *Allonnia* cf. *erromenosa*, *Nanjia-ngofolliculus* aff. *cyclicus* 등의 미화석이 기재되었다. 대상 화석군의 지질연대결정 과정을 토의하고, 문경지역에서 수행된 기존연구의 결과를 재고해서 본 석회암지층이 이 지역 하부고생대층중 최하위에 위치하는 구랑리층과 동시기 또는 구랑리층보다 후기에 형성된 것으로 제안한다.

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