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Fusulinids from the Limestone Gravels of the Jurassic Sapyeongri Formation, Danyang Coalfield, Korea

忠北 丹陽 附近의 쥬라紀 沙坪里層의 石灰岩礫에서 産出되는 紡錘蟲에 관한 硏究

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ABSTRACT: The Middle Jurassic Sapyeongri Formation distributed in the vicinity of Danyang Town contains limestone gravels which produce the Carboniferous Moscovian fusulinids such as *Ozawainella paratingi* Manukalova, *Pseudostaffella gorskyi* (Dutkevich), *P. kimi* Cheong, *P. dogensis* Cheong, *Neostaffella sphaeroidea* (Ehrenberg) *cuboides* Rauser, *N. hanensis* Cheong, *N. papilioformis?* Cheong, *Fusulinella jamesensis* Thompson, Pitrat and Sanderson, and *Beedeina* spp. Very similar fusulinid assemblages have been known from the thin limestone intercalations in the Manhang and Geumcheon formations in the Danyang and Samcheog coalfields. According to the present fusulinid study, it is clear that some of the sediments of the Sapyeongri Formation were originated from the outcrops of the Manhang and Geumcheon formations in the Danyang Coalfield.

要 約

忠北 丹陽 附近에 分布하는 砂坪里層을 구성하고 있는 일부 石灰岩礫에서 産出되는 紡錘虫은 *Ozawainella paratingi*, *Pseudostaffella gorskyi*, *P. kimi*, *P. dogensis*, *Neostaffella sphaeroidea cuboides*, *N. hanensis*, *N. papilioformis?*, *Beedeina* spp. 등등이다. 이들 紡錘虫의 地質時代는 石炭紀 Moscovian이다. 특히 이들은 三陟炭田과 丹陽炭田의 晩項層과 黔川層에서 産出되는 紡錘虫과 同一한 種들이다. 따라서 砂坪里層의 堆積物 一部는 丹陽炭田의 晩項層과 黔川層의 岩石으로부터 유래되었음이 分明하게 밝혀졌다.

Introduction

The Sapyeongri Formation, one of the formations of the Bansong Group, is distributed as a long, narrow, northeast-trending belt in the western part of the Danyang Coalfield (fig. 1). Several papers have been published on the Danyang Coalfield by Kobatake (1930), Son *et al.* (1969), Cheong (1971), and Park and Cheong (1975). The last one dealt with the sedimentary petrology of the group, especially of the conglomerate of the Sapyeongri Formation. As for the geologic age of the Bansong Group, the previous writers agreed with Kobayashi (1953) who suggested the age of the group to be the Jurassic. Son (1970), however, has shown a more detailed geologic age of the formation to range from the Bajocian to Callovian of the Middle Jurassic. The

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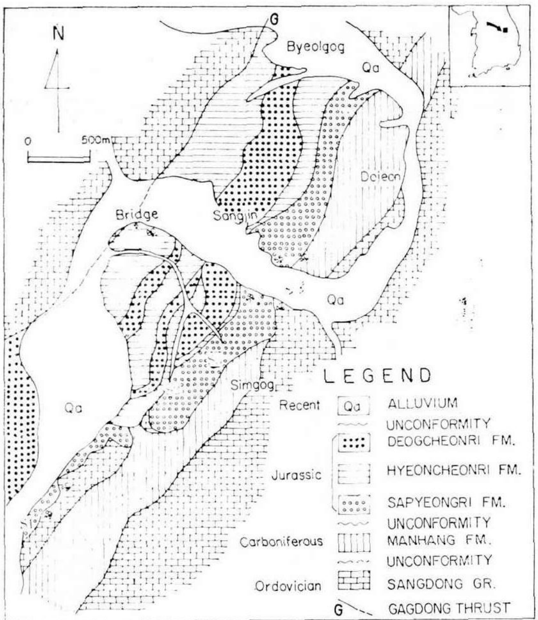

Jurassic	Bansong Group	Deogcheonri Fm.	Bansong Sy.	Bansong Series
		Hyeoncheonri Fm.		
		Sapyeongri Fm.		
Triassic?	Hwangji Group	Dong-go Fm.	Pyeogan System	Greenstone Series
		?		
		Gohanri Fm.		Gobangsan Series
		Dosa-gog Fm.		
Perm.	Cheolam Group	Hambaegsan Fm.		
		Jangseong Fm.		Sadong Series
Carbon.	Gomog Group	Geumcheon Fm.		
		Manhang Fm.		Hongjeom Series
Ordov.	Sangdong Group		Choseon	Great Ls. Series

Fig. 1. The distribution of the Sapyeongri Formation in the vicinity of Danyang Town and sample sites of limestone gravels (after Park and Cheong, 1975) (left), and the generalized sequence in the Danyang Coalfield (after Cheong, 1971) (right).

generalized stratigraphy of the Bansong Group in the Danyang Coalfield is illustrated in figure 1. According to the studies of the group (Kim, 1971; Park and Cheong, 1975) the direction of the paleocurrent was from east to west deviating southeast to northwest. Therefore, the source area of the sediments of the group is thought to have existed between the east and southeast of the Bansong Basin. The gravels of the formation appear to have been derived from the rocks of the Sangdong, Gomog, Cheolam and Hwangji groups (Park and Cheong, 1975). Park and Cheong (1975) and Kobayashi (1953) were of opinion that the depositional environment of the Bansong Group might have been a lake environment.

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Geologic Setting

The Sapyeongri Formation trends N30°E and is composed of cobbles, boulders and minor pebbles within a sand matrix. The matrix is composed of granule to fine sand-sized quartz grains and minor amounts of silty clay. The conglomerate is red, dark gray or greenish gray in color. The size of the gravels of the conglomerate ranges from -6.7ϕ to -5.9ϕ, so that the Sapyeongri Conglomerate can be referred as cobble conglomerate. The gravels of the conglomerate are composed of quartzite and sandstone, and minor amounts of slate, granite and limestone.

Some of the limestone gravels contain crinoid stems and Ordovician conodonts such as *Oistodus* sp., *Drepanodus* sp., *Scolopodus* sp. and some other gravels Carboniferous conodonts such as *Hindeodella* sp., *Lonchodina?* sp., *Ozarkodina* sp. and *Idiognathodus?* sp. (Park and Cheong, 1975).

The Sapyeongri Formation covers unconformably the Sangdong Group and the Manhang Formation in northeastern region. In northwestern part, the Sapyeongri Formation is covered with the Hyeoncheonri Formation conformably. The generalized columnar section of the Bansong Group is shown in figure 2.

The Sangdong Group: In the study area, the Sangdong Group is composed of the Mag-gol, the Goseong, the Heungweolri and Samtaesan formations. The first two crop out to the northeast of the Bansong Group. The rest are distributed to the northwest of the group. Cheong (1971) found *Distacodus* sp., which indicates the Ordovician time from the Goseong Formation. Kobatake (1930) found *Orthis nipponica* Kobayashi, *Rafinesquina chosensis* Kobayashi, gastropods and cephalopods from the same formation. The limestone of the Mag-gol Formation is light gray to medium gray in color, and the formation is composed of massive limestone. The Samtaesan and the Heungweolri formations are in fault contact with the Bansong Group. The fault has been named the Gagdong Thrust. The formations are composed of pinkish to white crystalline limestone and dolomite.

The Manhang Formation: The formation covers the Sangdong Group unconformably and is coverd with the Sapyeongri Formation. The Manhang Formation is composed of reddish shale, greenish gray arenaceous shale and sandstone. According to the fusulinid study by Cheong (1971), the geologic age of the formation is the upper Middle Carboniferous, the Moscovian. He found two genera of the Carboniferous coral fossils, *Diphyphyllum* sp. and *Arachnastraea* sp., from the upper limestone bed on the southern side of the Kosuri Pass of the Danyang Coalfield.

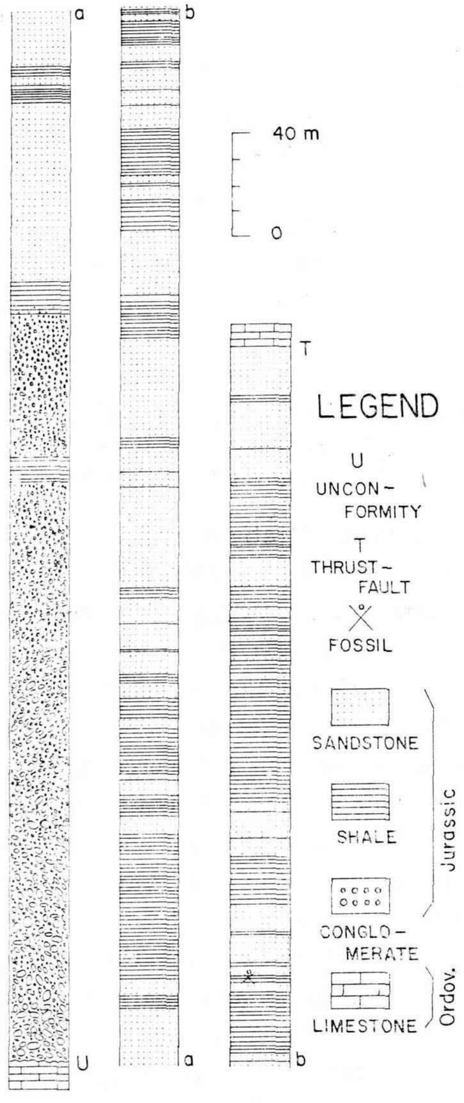

Fig. 2. Columnar section of the Bansong Group along the route 595 (after Park and Cheong, 1975).

The Hyeoncheonri Formation: The formation covers the Sapyeongri Formation conformably, and the Manhang Formation unconformably. The Hyeoncheonri Formation is composed of dark gray shale and sandstone. Park (1974) found the plant fossils, *i.e., Baiera gracilis* Bunb, *B. longifolia* (Pomel) and *Stigmaria* sp., and Kobatake (1930) *Podozamites lanceolatus* Lindl. and Hutt, *Czekanowskia rigida* Heer and *Phoennicopsis* sp.

The Deogcheon Formation: The formation covers the Hyeoncheonri Formation conformably and is in fault contact with the Heungweolri and the Samtaesan formations along the Gagdong thrust fault. The formation is composed of arkosic sandstone and dark gray shale. The Deogcheon and Hyeoncheonri formations crop out repeatedly due in part to the folding, and the width of their distribution varies with places where they are found.

Scope of Study

The present fusulinid study is based on the specimens found from the limestone gravels of the Sapyeongri Formation. The limestone gravels producing fusulinids are arenaceous and cherty, and light gray to dark gray in color. The limestone gravels were collected at three localities, and they are shown in figure 1 (S1, S2, and S3). The locality S1 is about 2.5 km north of Danyang Town along the route 5, and the stratigraphical level of the locality is the lowermost part of the Sapyeongri Formation. The limestone gravels associated with granite gravels are more or less abundant. At sample locality S2, the limestone gravels are the dominent component, and Ordovician and Carboniferous limestone gravels are found together. The stratigraphical level of the locality S2 is the upper part of the Sapyeongri Formation. At sample locality S3, the limestone gravels are sporadically distributed in the sandstone, and the amount of them is very small. The stratigraphical level of locality S3 is the middle part of the Sapyeongri Formation.

The materials studied are deposited in the Department of Geology, College of Natural Sciences, Seoul National University, Seoul, Korea.

Systematic Paleontology

Superfamily Fusulinacea von Möller, 1878

Family Ozawainellidae Thompson & Foster, 1937

Genus *Ozawainella* Thompson, 1935

Ozawainella paratingi Manukalova, 1950

Pl. I, fig. 1

1950, *Ozawainella paratingi* Manukalova, p.181—182, Pl. I, fig. 7.
1951, *Ozawainella paratingi,* Rauser *et al.*, p.138, II, figs. 11—12.
1973, *Ozawainella paratingi,* Cheong, p.56, Pl. I, figs. 21—22.
1974, *Ozawainella paratingi,* Cheong, p.73, Pl. I, figs. 21—22.
1977, *Ozawainella paratingi,* Cheong, p.156, Pl. I, fig. 1.

Description: The shell of *Ozawainella paratingi* is small, thickly lenticular, reaches

0.65 mm in length and 1.70 mm in diameter. Form ratio is 0.38. The periphery is sharply pointed and umbilical regions of the outer whorl are slightly convex. The lateral slopes are straight to slightly concave. Number of volutions is 7. Whorls are loosely coiled and composed of tectum, upper and lower tectoria. Chomata are weakly developed, and tunnel is triangular with flat base.

Remarks : The present material is very much similar to the Cheong's specimens (1973, Pl. Ⅰ, figs. 21, 22) except its form ratio, *i.e.*, form ratio of the present species is smaller than that of Cheong's.

Occurrence: Sample locality S1.

Geologic age: Upper Geumcheonian or *Fusulina cylindrica domodedovi* Subzone in Samcheog Coalfield in South Korea. Zone of *Fusulina cylindrica—F. quasicylindrica* of the Penchi Series in N. China, and the Mjachkov bed of Moscovian in USSR.

Family Fusulinidae von Möller, 1878

Subfamily Fusulininae von Möller, 1878

Genus *Pseudostaffella*, Thompson, 1942

***Pseudostaffella gorskyi* (Dutkevich, 1943)**

Pl. Ⅰ fig. 4

1934, *Staffella sphaeroidea* var. *gorskyi* Dutkevich, p.119—132, Pl. Ⅱ, figs. 16—17.

1950, *Pseudostaffella gorskyi* Grozd. et Leb., p.37—38, Pl. Ⅳ, figs. 5—7.

1960, *Pseudostaffella gorskyi*, Grozd. et Leb., p.128, Pl. XV, figs. 9—10.

1969, *Pseudostaffella gorskyi*, Manukalova *et al.*, p.69, Pl. XIII, figs. 10—12.

1973, *Pseudostaffella gorskyi*, Cheong, p.62, Pl. Ⅲ, fig. 1.

1974, *Pseudostaffella gorskyi*, Cheong, p.82—83. Pl. Ⅱ, fig. 1.

1977, *Pseudostaffella gorskyi*, Cheong, p.157—158, Pl. Ⅰ, fig. 15.

Description: Shell is minute, spheroid, and reaches 0.58 mm in length and 0.65 mm in diameter. Form ratio is 0.89. Number of volutions is four. Spirotheca coils loosely and is composed of tectum, upper and lower tectoria. Umbilici are flat and rather convex.

Remarks: In size, the present specimen is larger than that of Cheong's specimens (1973, Pl. Ⅲ, fig. 1; 1977, Pl. Ⅰ, fig.15) produced from the Manhang Formation in Samcheog Coalfield. The chomata which are prominent in Rauser's specimen are not clearly shown in this illustrated specimen due to its tangential section. The present material is somewhat similar to van Ginkel's *Pseudostaffella* sp. 1 (1965, Pl. XX, fig. 7).

Occurrence: Sample locality S1.

Geologic age: Upper Manhangian or *Pseudostaffella kimi* Subzone in Samcheog Coalfield. Zone of *Fusulina* (*Beedeina*) in Japan. Zone of *Fusulina* (*Beedeina*) *konnoi* in the Pench Series. Podol bed in USSR.

***Pseudostaffella kimi* Cheong**

Pl. Ⅰ, fig. 5

1973, *Pseudostaffella kimi* Cheong, p.63, Pl. Ⅲ, figs. 2—4.

1974, *Pseudostaffella kimi*, Cheong, p.64, Pl. Ⅰ, figs. 2—9.

Description: Shell is minute, drum shaped, 0.55 mm in length and 0.75 mm in diameter. Form ratio is 0.73. The middle periphery[1)] is straight to slightly convex, and umbilical regions are not clear in this specimen. The specimen is characterized by bulging lateral peripheries[1)]. Number of volutions is five. Spirotheca is loosely coiled and composed of tectum, upper and lower tectoria. Tunnel angles of the third and fourth volutions are 25° and 22°, respectively. Chomata is prominent and reaches 3/4 or more of the volution height.

Remarks: In specimen measured, the tunnel angle is larger than that of Cheong's (1973, Pl. Ⅲ, figs. 2-4) specimens. The middle periphery of the fourth and fifth volutions is straight to slightly convex.

Occurrence: Sample locality S3.

Geologic age: Upper Manhangian and Geumcheonian in Samcheog Coalfield. Upper Zone of *Fusulinella - Fusulina* in Fukuji. *Fusulinella - Fusulina* Zone in the Penchi Series. Podol bed and Mjachkov bed in USSR.

Pseudostaffella dogensis Cheong
Pl. Ⅰ, figs. 6, 7

1973, *Pseudostaffella dogensis* Cheong, P. 63, Pl. Ⅲ, figs. 5—6.
1974, *Pseudostaffella dogensis*, Cheong, p. 66—68, Pl. Ⅰ, figs. 10—13.

Description: Shell is small, drum shaped, 0.75 mm in length and 1.25 mm in diameter. Form ratio is about 0.60. The middle peripheries of the inner three volutions are straight to slightly convex, but those of the fourth and fifth are concave with concavity[2)] of 0.80 and 0.98, respectively. The lateral peripheries are characterized by bulging feature and the bulginess is 2.03. The lateral slopes are straight to slightly convex. Concave and rather flat umbilici are developed, and its concavity is 0.87. Number of volutions is seven. The spirotheca is loosley coiled, and the height of the volution increases gradually, but it decreases considerably at the last whorl. Spirotheca is composed of tectum, sporadical diaphanotheca, upper and lower tectoria. The concave middle periphery and the broadly concave umbilici are the remarkable characteristics of *Pseudostaffella dogensis.* Tunnel angle of the fourth and fifth volutions are about 10 degrees. Well developed round and massive chomata are symmetrical. The height of chomata increases towards lateral peripheries, and reaches 3/4 or more of the volution height.

Remarks: In the present species, tunnel angle is low and narrow, and tunnel way is more or less regular. The remarkable characteristics of the material is well developed chomata.

Occurrence: Sample localities S2 and S1.

Geologic age: Geumcheonian in Samcheog Coalfield. Upper Zone of *Fusulinella-Fusulina* in Fukuji and in the Penchi Series. Mjachikov bed in USSR.

Note 1). Middle and lateral peripheries have been named by Cheong (1973, 1974). The former corresponds to the middle part of the periphery and the latter four diagonal parts. These two terms can only be used for the forms which have cuboid or caltrop shaped *Pseudostaffella, Neostaffella* and the like.

2). Concavity is a measure to give numerical value of the concave middle periphery and the concave umbilici.

Genus *Neostaffella* Miklucho-Maclay, 1959

1959, *Neostaffella* Miklucho-Maclay, p. 530.
1974, *Neostaffella*, Cheong, p. 68 (emend)

Neostaffella sphaeroidea (Ehrenberg) *cuboides* Rauser
Pl. Ⅰ figs. 9, 10, 11

1951, *Pseudostaffella sphaeroidea* (Ehrenberg) var. *cuboides* Rauser, p. 129, Pl. Ⅳ, figs. 6—7.
1971, *Pseudostaffella sphaeroidea* var. *cuboides*, Cheong, p. 75—76, Pl. Ⅳ, figs. 3—11.
1973, *Neostaffella sphaeroidea* (Ehrenberg) var. *cuboides*, Cheong, p. 64, Pl. Ⅲ, figs. 7—9.

Description: Shell is small, spheroidal to drum shaped, 1.50 to 1.90 mm in length and 1.50 to 1.90 mm in diameter. Form ratio is about 1.00. The outside diameter of the proloculus ranges from 0.20 to 0.25 mm. The periphery is straight to slightly convex, and the umbilical regions are straight to slightly concave. Number of volutions is 7 to 8, and the height of the volution increases slightly. Spirotheca is loosely coiled and composed of tectum, diaphanotheca, upper and lower tectoria. Tunnel angle is about 17 degrees at the fifth and sixth volutions. Chomata develops prominently at lateral peripheries, and reaches 3/4 or more of the volution height.

Remarks: The middle perphery of the present specimens is flatter than *Neostaffella sphaeroidea*. Among the materials the specimen figure 9 in plate Ⅰ is similar to *Neostaffella sphaeroidea*.

Occurrence: Sample localities S1, S2 and S3.

Geologic age: Lower Geumcheonian or *Neostaffella sphaeroidea cuboides* Subzone in Samcheog Coalfield. Upper Zone of *Fusulinella-Fusulina* in Fukuji. Subzone of *Pseudostaffella sphaeroidea* in the Penchi Series. Lower Mjachikov bed in USSR.

Neostaffella hanensis Cheong
Pl. Ⅰ, figs. 12—17, Pl. Ⅱ, figs. 1, 2

1973, *Neostaffella hanensis* Cheong, p. 47—82, Pl. Ⅲ, figs. 10—13.
1974, *Neostaffella hanensis*, Cheong, p. 59—88, Pl. Ⅰ, figs. 14—21.
1978, *Neostaffella* aff. *hanensis*, Niikawa, p. 533—610, figs. 11—12.

Description: Shell is small, drum-shaped, 1.45 to 2.00 mm in length and 1.45 to 2.00 mm in diameter. Form ratio is about 1.00. The middle perphery is slightly concave with concavity of 0.86 to 0.94. The umbilical poles are slightly concave with concavity of 0.82 to 0.88. Lateral perpheries are semicircular and the bulginess is about 2.90. The lateral slopes are straight to slightly convex. Number of volutions is 7 to 8 and the height of the volution increases slowly. Spirotheca is composed of tectum, weak diaphanotheca, upper and lower tectoria. The septa are unfluted. Tunnel angles range from 14 to 22 degrees. The outside diameter of the proloculus measures 0.10 mm. Ribbon-like massive chomata develop prominently from the tunnel side to the umbilical regions, thinning toward the poles. The tunnel path is regular. The height of chomata is 3/4 or more of the volution height.

Remarks: Neostaffella hanensis is very similar to *Pseudostaffella greenlandia* Ross and Dunbar in shape, but the volutions are smaller in number in the latter.

One of the present species, *i.e.*, fig. 1 in plate II, is very much similar to Niikawa's *Neostaffella* aff. *hanensis* reported from the Ichinotani Formation, Fukuji, Central Japan. Tunnel angle of the *N. hanensis* is smaller than that of *P. greenlandica.*

Occurrence: Sample localities S1, S2 and S3.

Geologic age: Geumcheonian in Samcheog Coalfield. Zone of *Fusulinella-Fusulina* in the Penchi Series and Mjachikov bed in USSR.

Neostaffella papilioformis? Cheong
Pl. II fig. 3

1934, *Staffella paradoxa* Dutkevich, p.65, Pl. I, figs. 9—10, Pl. II, figs. 1—10.
1973, *Neostaffella papilioformis* Cheong, p.65—66, Pl. III, figs. 14—17.
1974, *Neostaffella papilioformis,* Cheong, p.70—73, Pl. II, figs. 1—7, Pl. IV, figs. 1—4.
1977, *Neostaffella papilioformis,* Cheong, p.158, Pl. II, figs. 3—7.

Description: Shell is small, drum-shaped, 1.35 mm in length and 1.60 mm in diameter. Form ratio is 0.84. The outside diameter of the proloculus is 0.20 mm. The middle periphery is concave with concavity of about 0.89. The umbilical poles are concave with concavity of about 0.83. Lateral slopes are straight to slightly convex and lateral peripheries are bluntly rounded. The bulginess is about 2.81 in the outermost whorl. Number of volutions is 7. Spirotheca is composed of tectum, diaphanotheca, upper and lower tectoria. The height of the volution increases slowly. Tunnel angles of the fifth and sixth volutions are 9 and 15 degrees, respectively. Chomata are thick and prominent in the lateral peripheries. The height of the chomata is 3/4 or more of the volution height.

Remarks: The present species is larger than Cheong's type species in length and diameter. Also the form ratio of the present species is greater than that of Cheong's type species. But the concavities of middle peripheries and umbilical regions are smaller than that of Cheong's species probably due to deformation of the present species.

Occurrence: Sample locality S1.

Geologic age: Middle and Upper Geumcheonian or subzones of *Fusulinella soni* and *Fusulina cylindrica domodedovi* in Samcheog Coalfield. Upper Zone of *Fusulinella-Fusulina* in Fukuji. Subzones of *Fusulinella provecta* and *Fusulina cylindrica-F. quasicylindrica* in the Penchi Series. Mjachikov bed in USSR.

Genus *Fusulinella* Möller 1900
Fusulinella jamesensis Thompson, Pitrat & Sanderson, 1953

1953, *Fusulinella jamesensis* Thompson, Pitrat & Sanderson, p.548~550, Pl. 57, figs. 8—15.
1957, *Fusulinella jamesensis,* Igo, p.206~207, Pl. VII, figs. 1—9.
1963, *Fusulinella jamesensis,* Ishizaki, p.109, Pl. XVI, figs. 4—5.

Description: Shell is small, thickly fusiform, 2.00 mm in length and 1.20 mm in diameter.

Form ratio is 0.67. The proloculus is medium, 0.10 mm in outside diameter. The first two volutions are low and subglobose. Succeeding three volutions gradually increase more in length than in diameter to attain a thick fusiform outline with bluntly to slightly pointed poles. The number of volutions is five. In the specimen measured, the spirotheca is thin, and composed of diaphanotheca, thin tectum, upper and lower tectoria, but such features can hardly be observed in the last volution. The tunnel angles of the second to the fourth volution are 17°, 19° and 32°, respectively. The chomata are asymmetrical, narrow, and merge with secondary deposits that coat the septa near the tunnel. The height of chomata is one half or slightly more of the volution height. The chomata are steep to vertical tunnel sides and slope gently poleward.

Remarks: The present specimen differs from Thompson, Pitrat and Sanderson's holotype in tunnel angle. The tunnel path of the present specimen is characteristic of being steep to vertical tunnel sides.

Occurrence: Sample locality S1.

Geologic age: Lower and middle Geumcheonian or Subzone of *Neostaffella sphaeroidea cuboides* or of *Fusulinella soni* in Samcheog Coalfield. Upper Zone of *Fusulinella-Fusulina* in Fukuji. Subzone of *Pseudostaffella sphaeroidea* or of *Fusulinella provecta* in the Penchi Series and Mjachkov bed in USSR.

Genus *Beedeina* Galloway, 1933

1933, *Beedeina* Galloway, p.401—402.
1957, *Beedeina*, Ishii, p.655.
1963, *Beedeina*, Miklucho-Maclay, p.202, p.299
1965, *Beedeina*, van Ginkel, p.128—129.
1966, *Girtyina*, Kahler & Kahler, p.364—368.

***Beedeina* spp.** Pl. Ⅱ, **figs. 7—10**

Description: Shell is large, elongate fusiform, about 5.70 mm in length and 1.50 mm in diameter. Form ratio is 3.80. The height of the volutions increases slowly, but rapidly in the last volution. Septa are strongly folded. The spirotheca is composed of tectum, diaphanotheca, upper and lower tectoria. The thicknesses of the first to the fifth volution are 0.05 mm, 0.04 mm, 0.6 mm, 0.05 mm and 0.04 mm, respectively. Thickness of spirotheca is not uniform due largely to the variations of thickness of tectoria. Chomata are prominently developed adjacent to the tunnel in all, except that in its last volution.

Occurrence: Sample locality S2.

Geologic age: Upper Geumcheonian?

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Explanation of Plate Ⅰ

Fig. 1. *Ozawainella paratingi* Manukalova, tangential section, ×40.

Figs. 2—3. *Pseudostaffella* spp., 2, tangential section; 3, oblique section; all ×40. (no description)

Fig. 4. *Pseudostaffella gorskyi* (Dutkevich), slightly axial section, ×40.

Fig. 5. *Pseudostaffella kimi* Cheong, slightly axial section, ×40.

Figs. 6—7. *Pseudostaffella dogensis* Cheong, 6, tangential section, ×20 ; 7, slightly axial section, ×40.

Figs. 8, 18. *Neostaffella* spp., 8, sagittal section; 18, oblique section; all ×20. (no description)

Figs. 9—11. *Neostaffella sphaeroidea cuboides* Raurser, 9, axial section; 10, 11, tangential sections; all×20.

Figs. 12—17. *Neostaffella hanensis* Cheong, 12, 13, axial sections; 14, tangential section; 15, 16, 17 sagittal sections; all ×20.

Explanation of Plate Ⅱ

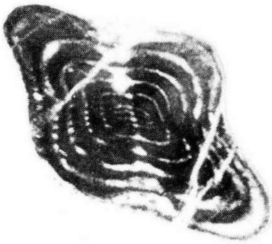
Figs. 1—2. *Neostaffella hanensis* Cheong, 1, 2, tangential sections; all ×20.

Fig. 3. *Neostaffella papilioformis*? Cheong, axial section, ×20.

Figs. 4—5. Fusulinella spp., 4, 5, sagittal sections, all ×20.

Fig. 6. *Fusulinella jamesensis* Thompson, Pitrat & Sanderson, axial section, ×20.

Figs. 7—10. *Beedeina* spp., 7, sagittal section; 8, 10, tangential sections; 9, obligue section; all ×15.



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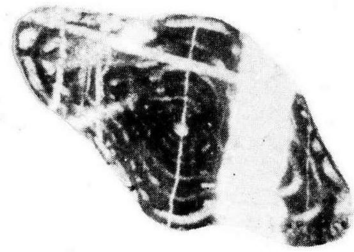

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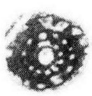

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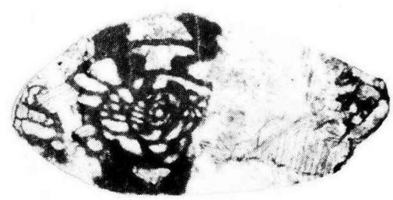

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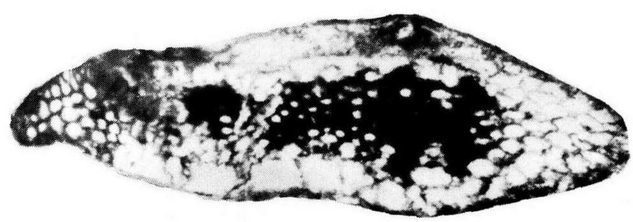

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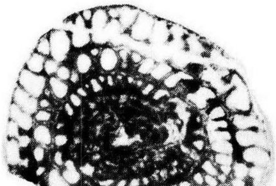

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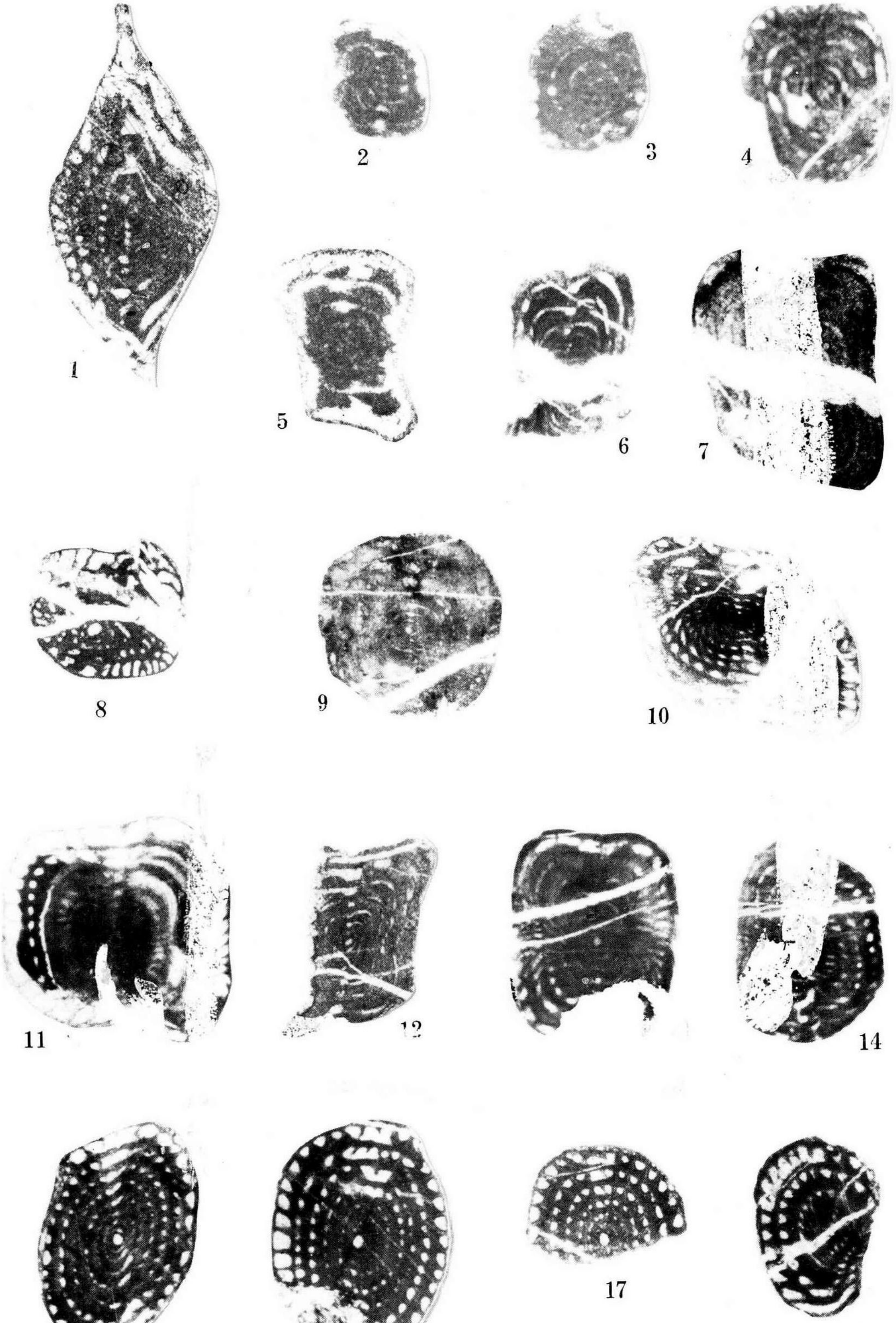
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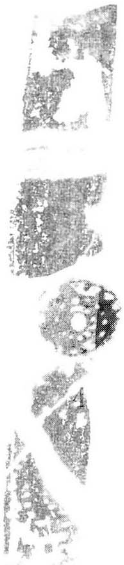

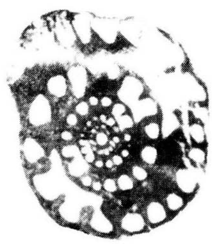

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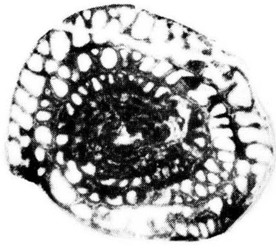

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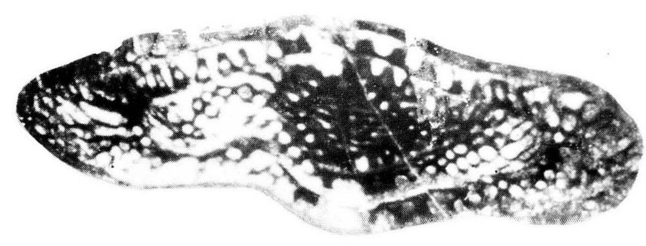

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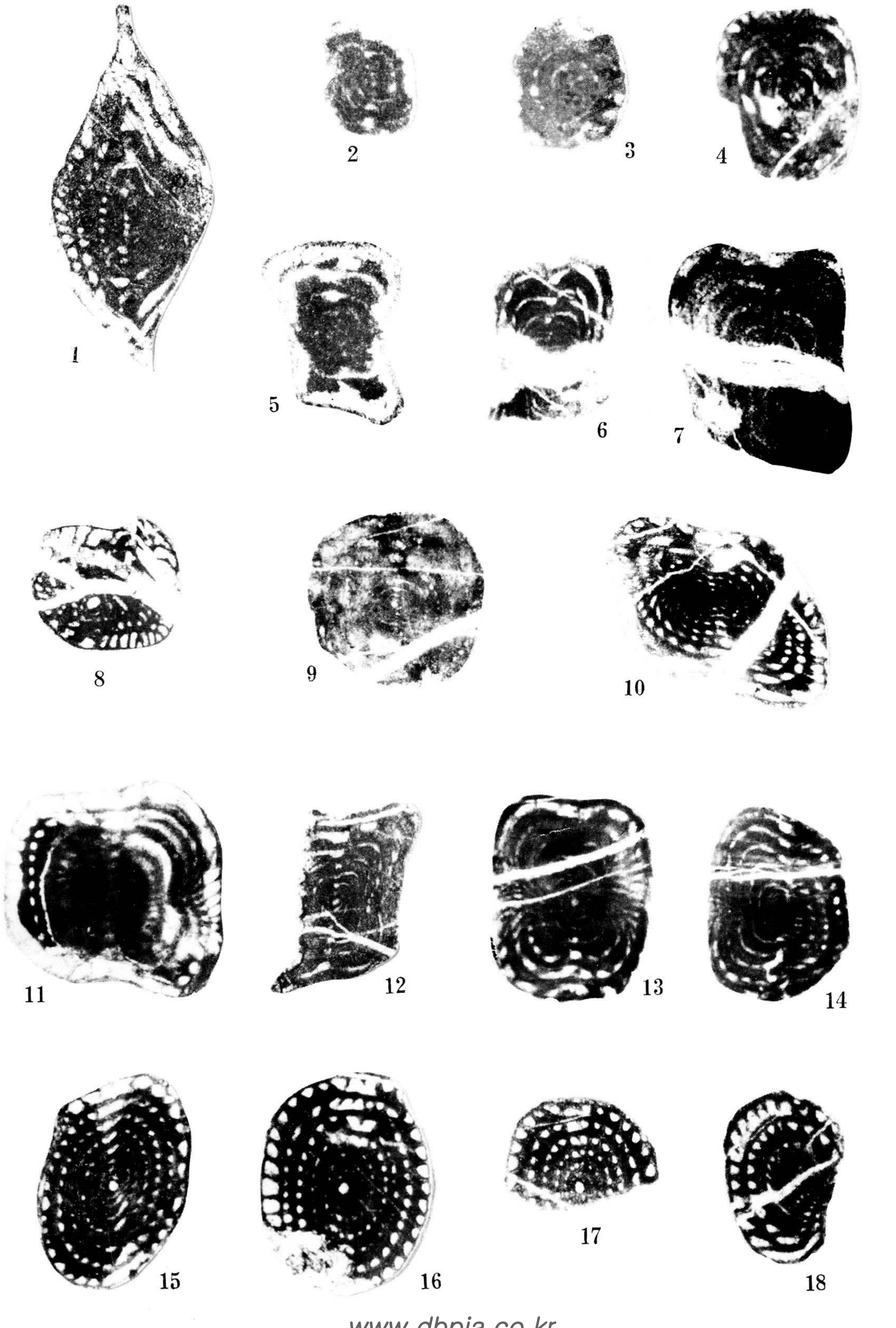
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