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Report

Pre-Capitanian (pre-upper Middle Permian) foraminifers contained in the limestone conglomerate of the Permian Maizuru Group in the Miharaiyama area, Oya-cho, Yabu, Hyogo—Late Paleozoic and Early Mesozoic foraminifers of Hyogo, Prefecture, Japan, Part 14—

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Abstract

Pre-Capitanian foraminiferal faunas are discriminated in 32 samples of limestone granules to cobbles of erratic limestone conglomerates in the Miharaiyama area, Yabu, Hyogo. These limestone fragments are enclosed densely or sparsely within conglomerates of arenaceous matrix different from those of calcareous argillaceous matrix having the *Lepidolina kumaensis* fauna. They are thought to have been derived from the Middle Formation of the Permian Maizuru Group. Based on these foraminiferal assemblages, approximate age is determined or estimated in 20 samples including the Bashkirian two ones previously thought to have been originated from the basal conglomerate of the Lower Triassic Yakuno Group overlying unconformably the Middle Formation of the Maizuru Group. These 20 samples are divided into eight groups of different ages, late Visean, late Serpukhovian to early Bashkirian, late Bashkirian, middle Moscovian, early Gzhelian, late Asselian, Artinskian, and late Wordian..

Key words: Foraminifers, pre-Capitanian, limestone conglomerate, Maizuru Group, Miharaiyama area

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Introduction

Strata in the Miharaiyama area in Yabu City, Hyogo Prefecture have been noticed on account of the Permian Maizuru Group unconformably overlain by the Triassic Yakuno Group (Nakazawa and Shiki, 1954; Hase et al., 1983). Kobayashi (2003) reconfirmed this relation based on the absence of stratigraphic interval having limestone blocks with Lopingian foraminifers common in the Upper Formation of the Maizuru Group. In the area, strata locally called the Minamitani Group (Nakazawa and Shiki, 1954) or Akenobe and Oya formations (Hirokawa et al., 1954) are thought to be correlated to the Lower and Middle formations of the Maizuru Group in the Maizuru area (Suzuki, 1987). Those called the Miharaiyama Group divisible into the lower Niikuradani and the upper Gannosudani formations (Nakazawa and Shiki, 1954) correspond to the Honodani Formation of the Yakuno Group in the Yakuno area (Nakazawa et al., 1958). Faunas characteristic in the Middle Formation of the Maizuru

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Group are late Middle Permian foraminifers from the limestone conglomerates and those in the Yakuno Group are Early Triassic pelecypods and ammonoids from sandstones in the Miharaiyama area (Nakazawa and Shiki, 1954; Hase et al., 1983). The Lower Formation of the Maizuru Group mainly consists of basaltic rocks.

Limestone conglomerate of the Maizuru Group is divided into two types based on differences of composition of their matrices (Kobayashi, 2003, 2010). The late Capitanian *Lepidolina kumaensis* fauna occurs in the conglomerate of calcareous argillaceous matrix. Whereas, pre-Capitanian foraminifers are exclusively contained in the conglomerate of arenaceous to argillaceous matrix throughout the Maizuru Terrane (Nogami, 1959; Kobayashi, 2003, 2010). Foraminifers from the former type of the conglomerate in Miharaiyama area were described by Kobayashi (2006). Limestone fragments in the conglomerate are very rare or almost absent in the Triassic formations, by which the assignment of a stratigraphic unit or an interval with conglomerate either the Permian or the Triassic is estimated in the Maizuru Terrane.

For the purpose of comparison of foraminiferal faunas of the Maizuru Group with those of other areas of Japan and consideration of their derivations, the present author also collected many samples of limestone conglomerates of arenaceous matrix in the Miharaiyama area. This paper reports the pre-Capitanian foraminiferal assemblages and considers the chronologic distribution of limestone fragments

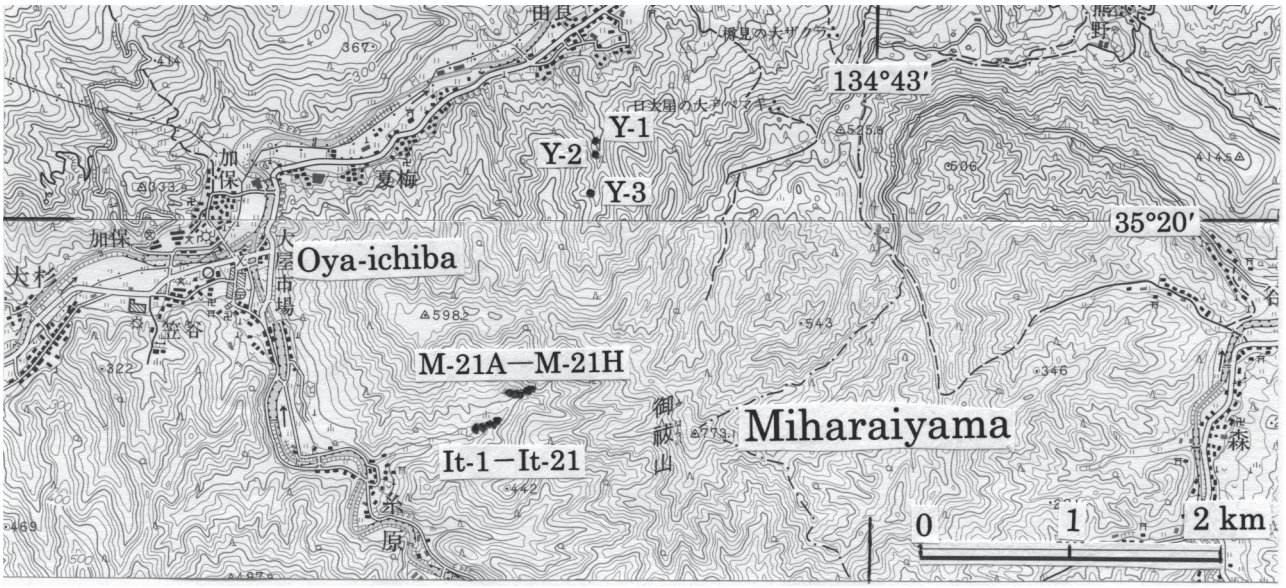


Fig. 1. Sample locality of limestone conglomerate of the Maizuru Group in the Miharaiyama area. Topographical map is from 1:50,000 maps “Oya-ichiba” and “Muraoka” published by the Geospatial Information Authority of Japan.

contained in the conglomerates, as the fourteenth of a series of descriptive works of Hyogo foraminifers. Two hundred and eight limestone thin sections prepared in this report are stored in the Museum of Nature and Human Activities, Hyogo, Japan (Fumio Kobayashi Collection, MNHAH).

Material

Thirty-two samples of limestone granules to cobbles contained in the erratic conglomerates with arenaceous matrix were collected along the upper stream of the small valley east of Itohara and along Yurazawa (Fig. 1). Although exact situation and lateral distribution of the conglomerates are not ascertained, many erratic limestone conglomerates are sporadically found along the valley east of Itohara. Limestone granules to cobbles are rounded to subrounded, mostly of less than 10 cm, 15 cm in the maximum. They are enclosed densely or sparsely within the matrix of bluish fine- to medium-grained sandstone. In addition to them, those of chert, acidic tuff, diabasic to andesitic rocks, and sandy to muddy rocks are contained. These erratic limestone conglomerates are confined to their distributional area both stratigraphically and topographically lower than the basal part of the Yakuno Group in the Miharaiyama area. They are all thought to have been

derived from the Middle Formation of the Maizuru Group.

Two samples of erratic pebbles (It-9 and M-21H) having *Pseudostaffellla* and *Verella* are revised herein to have been originated not from the basal conglomerate of the Yakuno Group as previously thought by Kobayashi (2003) but from the Middle Formation of the Maizuru Group as well as remaining 30 samples. Because, limestone conglomerates lithologically similar to those in the Miharaiyama area are not contained in the Yakuno Group in Hyogo and Kyoto prefectures, in spite of the report of *Neoschwagerina* and *Pseudofusulina* from the basal conglomerate of the Yakuno Group in the Miharaiyama area (Nakazawa and Shiki, 1954). They are unexceptionally restricted to the Middle and Upper

	It-1	It-3	It-4	It-5	It-7	It-8	It-10	It-11	It-13	It-20	It-21	M-21A	M-21C	M-21D	M-21E	M-21G	Y-2	Y-3
Cornuspira sp.																		×
Globivalvulina sp. A																		×
Globivalvulina sp. B															×			
Globivalvulina sp. C														×				
Asteroarchaediscus? sp.															×			
Endothyra sp. A															×			
Endothyra sp. B									×						×			
Endothyra? sp.															×			
Omphalotis samarica			×															
Planoendothyra sp.		×	×															×
Janischewskina sp.															×			
Bradyina cribrostomata		×																
Bradyina sp.		×																
Endothyranopsis? sp.			×															
Endostaffella sp.															×			
Spireitlina sp.						×												
Endospiroplectammina sp.				×														
Deckerella sp.															×			
Tetrataxis sp. A																×		
Tetrataxis sp. B																		×
Glomomidiella sp.														×				
Mediocris breviscula		×																
Eostaffella kanmerai	×										×							
Eostaffella mirifica																×		
Eostaffella sp. A																×		
Eostaffella sp. B																		×
Eostaffella sp. C	×																	
Pseudoendothyra sp.															×			
Parastaffelloides sp.							×											
Eoschubertella sp.				×														
Schubertella kingi														×				
Mesoschubertella? sp.																	×	
Profusulinella sp.												×						
Fusulinella biconica							×											
Kanmeraia itoi														×				
Pseudofusulinella sp.						×												
Rauserites sp.								×										
Schwagerina krotowi										×								
Chalaroschwagerina vulgaris						×												
Pseudofusulina fusiformis						×												
Leeina kraffti					×													
Paraschwagerina? sp.						×												
Neoschwagerina sp.													×					

Fig. 2. Foraminiferal species recognized in 18 samples of limestone conglomerate of the Maizuru Group in the Miharaiyama area in this paper. Sample numbers correspond to those in Fig. 1. Fusulines such as Pseudostaffella and Verella contained in two samples (It-9 and M-21H) are illustrated in Kobayashi (2003).

formations of the Maizuru Group (Kobayashi, 2010). Limestone fragments contained in the Yakuno Group consist mostly of the oolid grainstone/packstone exclusively having Anisian foraminifers and are quite different from the Permian ones (Kobayashi, 2008a; 2008b).

Chronologic distribution of limestone fragments

Foraminifers contained in most samples of erratic limestone conglomerates of the Miharaiyama area (Figs. 2–4) are similar in general to those of the Akiyoshi Limestone Group (T. Ozawa and Kobayashi, 1990; unpublished data by the author) as well as their lithological characters. Exceptional examples are above-mentioned two pebbles (It-9 and M-21H) of late Bashkirian age having continental affinity with detrital quartz grains (Kobayashi, 2003). Approximate age is determined or estimated in 20 samples including these two samples based on the comparison with foraminiferal assemblages and their biostratigraphic distribution studied by previous workers in the Akiyoshi Limestone Group and others. Age calibration of other 12 samples is almost impossible on account of absence of age-diagnostic taxa or free from foraminifers.

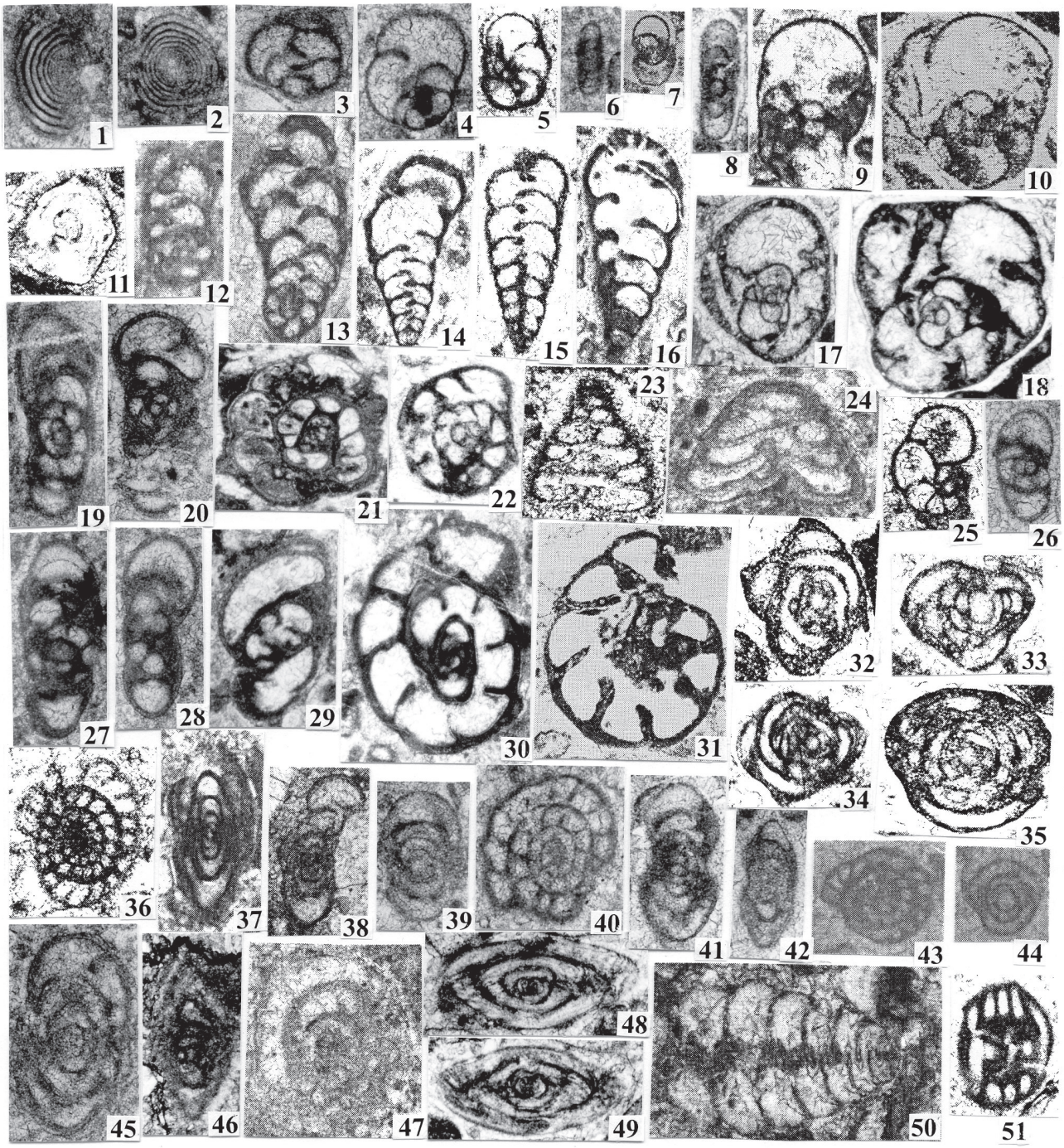
As the result, these 20 samples are divided into eight groups of different ages, late Visean, late Serpukhovian to early Bashkirian, late Bashkirian, middle Moscovian, early Gzhelian, late Asselian, Artinskian, and late Wordian.

Sample M-21E is thought to be late Visean from the occurrence of *Janischewskina* sp. [Fig. 3-9, 10] and *Eostaffella mirifica* Brazhnikova in Brazhnikova et al. (1967) [Fig. 3-46]. *Janischeskina* sp., though excentered and partly destroyed and recrystallized in the last whorl, might be comparable to the types of *Janischeskina typica* Mikhailova, 1935 from the upper Visean of Samara Bend region of the Volga River. *Eostaffella kanmerai* (Igo, 1957) [Fig. 3-36, 37] is found from sample It-1 and It-21. It co-exists with *Janischeskina typica* and *Mediocris mediocris* (Vissarionova, 1948) in the basal part of the Ichinotani Formation (unpublished data by the author). Sample It-4 containing *Omphalotis samarica* Rauser-Chernousova, 1948 [Fig. 3-29–31] and *Endothyranopsis*? sp. is also assigned to late Visean, since most of the former are reported from the upper Visean and *Endothyranopsis* is characteristic in the Visean rather than in early Serpukhovian in general.

Bradyina cribrostomata [Fig. 3-17, 18] was originally described by Rauser-Chernousova and Reitlinger in Rauser-Chernousova (1937) from the transitional beds between Lower and Middle Carboniferous of the Samara Bend region of the Volga River. *Bradyina* contained in It-3 is probably identified with the types from Samara Bend. This species is commonly found in the limestones correlatable to the Serpukhovian and lower Bashkirian of the Akiyoshi Limestone Group. Y-3 with *Planoendothyra* sp. [Fig. 3-27, 28] and *Eostaffella* sp. B [Fig. 3-39, 40, 45], and It-13 with *Endothyra* sp. B [Fig. 3-21] are provisionally thought to be the same age as of It-3.

The tangential section from sample M-21A [Fig. 3-51] is probably assignable to a species of *Profusulinella*. Small fusulines possibly referable to *Eoschubertella* [Fig. 3-43, 44], though their

Fig. 3. 1, 2: *Cornuspira* sp., 1: D2-022939, 2: D2-022940, both Y-3, ×60. **3, 4**: *Globivalvulina* sp. A, both D2-022938, Y-3, × 60. **5**: *Globivalvulina* sp. B, D2-023148, M-21E, ×50. **6**: *Mediocris breviscula* (Ganelina, 1951), D2-022958, It-3, ×80 **7?, 26**: *Endothyra*? sp., 7: D2-023135, ×50; 26: D2-023144, ×60, both M-21E. **8**: *Endostaffella* sp., D2-023137, M-21E, × 60. **9, 10**: *Janischewskina* sp., 9: D2-023135, 10: D2-023159; both M-21E, ×40. **11**: *Asteroarchaediscus*? sp., D2-023153, M-21E, ×50. **12**: *Spireitlina* sp., D2-022979, It-8, ×50. **13**: *Endospiroplectammina* sp., D2-022968, It-5, ×50. **14–16**: *Deckerella* sp. 14: D2-023145, 15; D2-023150, 16; D2-023134; all M-21E, ×50. **17, 18**: *Bradyina cribrostomata* Rauser-Chernousova and Reitlinger in Rauser-Chernousova, 1937, 17: D2-022957, ×30; 18: D2-022953, ×25; both It-3, ×25. **19, 20, 27, 28**: *Planoendothyra* sp., 19: D2-022963, It-4; 20: D2-022955, It-3; 27: D2-022939, Y-3; 28: D2-022940, Y-3; all ×60. **21**: *Endothyra* sp. B, D2-023024, It-13, ×30. **22**: *Endothyra* sp. A, D2-023155, M-21E, ×40. **23**: *Tetrataxis* sp. A, D2-023170, M-21G, ×50. **24**: *Tetrataxis* sp. B, D2-022940, Y-3, ×40. **25**: *Globivalvulina* sp. C, D2-023121, M-21D, ×50. **29 –31**: *Omphalotis samarica* Rauser-Chernousova, 1948, 29, 30: D2-022963, It-4; 30: D2-023164, M-21E, all ×30. **32–35**; *Glomomidiella* sp., 32: D2-023126, 33: D2-023133, 34: D2-023116, 35: D2-023124; all M-21D, ×50. **36, 37**: *Eostaffella kanmerai* (Igo, 1957), 36: D2-023051, It-21; 37: D2-022947, It-1; both ×50. **38**: *Eostaffella* sp. C, D2-022947, It-1, ×50. **39, 40, 45**: *Eostaffella* sp. B, 39: D2-022940, 40: D2-022938, 45: D2-022939; all Y-3, ×60. **41, 42**: *Eostaffella* sp. A, 40: D2-023147, 41: D2-023148, both M-21E, ×60. **43, 44**: *Eoschubertella* sp., both D2-022971, It-5, ×50. **46**: *Eostaffella mirifica* Brazhnikova in Brazikova and others, 1967, D2-023151, M-21E, ×40. **47**: *Mesoschubertella*? sp., D2-022937, Y-2, ×30. **48, 49**: *Schubertella kingi* Dunbar and Skinner, 1937, 48: D2-023116, 49: D2-023115, both M-21D, ×40. **50**: *Climacammina* sp., D2-022948, It-1×50. **51**: *Profusulinella* sp., D2-023104, M-21A, ×40.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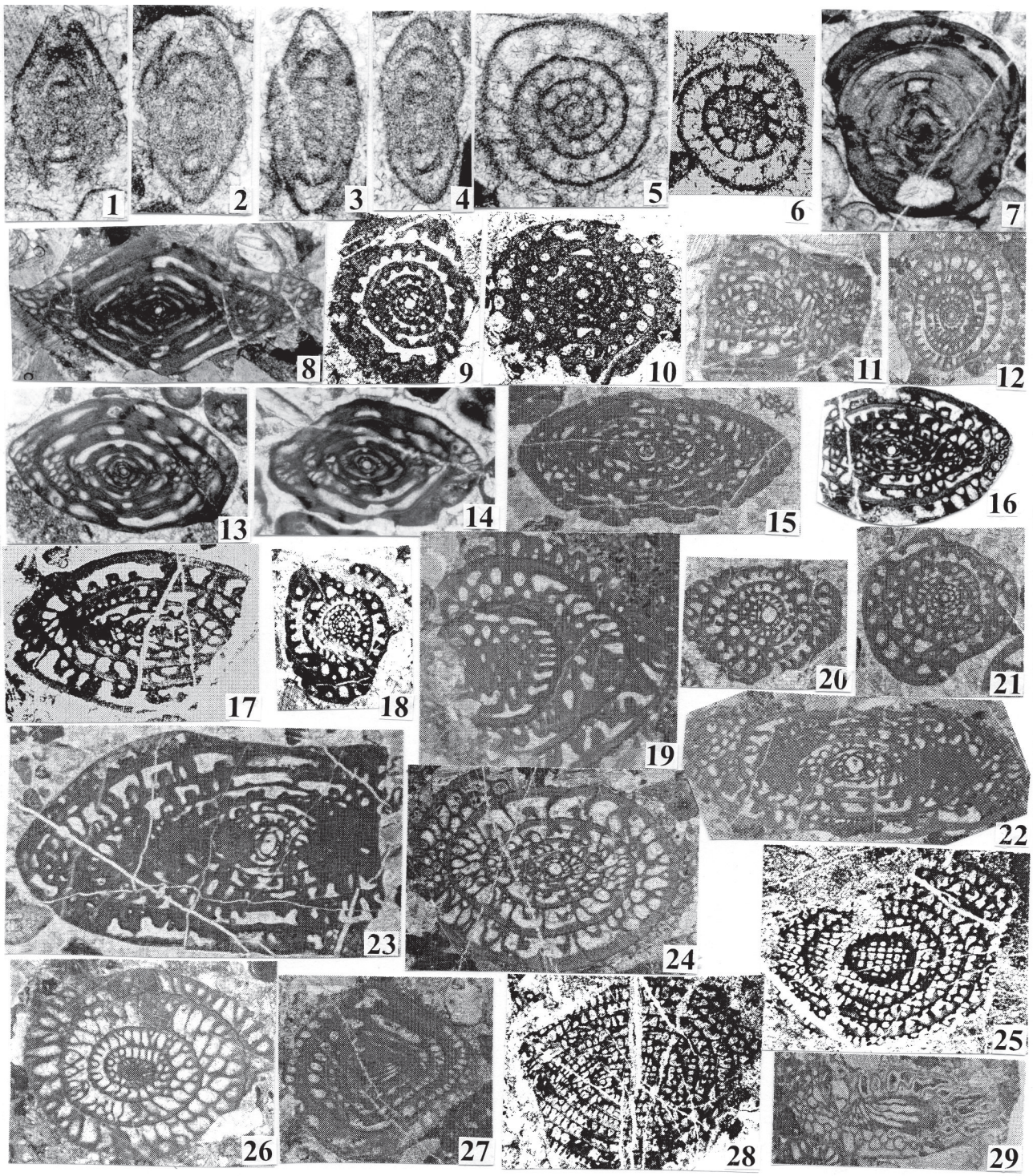

Fig. 4. 1–6: *Pseudoendothyra* sp., 1: D2-023122, 2, 3: D2-023132, 4: D2-023123, 5: D-023124, 6: D2-023125; all M-21D, ×50. **7**: *Parastaffelloides* sp., D2-023016, It-10, ×20. **8–10**: *Kanmeraia itoi* (Y. Ozawa, 1925), 8: D2-023117, ×15; 9: D2-023115, × 25; 10: D2-023113, ×25; all M-21D. **11, 12, 29**: *Rauserites* sp., 11: D2-023019, 12, 29: D2-023018, all It-11, all ×10. **13, 14**: *Fusulinella biconica* Hayasaka, 1924, 13: D2-023017, 14: D2-023015, both It-10, ×15. **15–17, 18?, 20, 21**: *Schwagerina krotowi* (Schellwien, 1908), 15, 21: D2-023045, 16: D2-023042, 17: D2-023043, 18: D2-023047, 20: D2-023044; all It-20, 15, 17, 21: ×15; 16, 18: ×10. 19, 24: *Chalaroschwagerina vulgaris* (Schellwien, 1909), 19: D2-022979, 24: D22-022978, both It-8, ×10. **22**: *Pseudofusulina fusiformis* (Schellwien, 1909), D2-022980, It-8, ×10. **23**: *Leeina kraffti* (Schellwien, 1909), D2-022976, It-7, ×10. **25, 28**: *Neoschwagerina* sp., 25: D2-023112, 28: D2-023111, both M-21C, ×10. **26**: *Paraschwagerina*? sp., D2-022978, It-8, ×10. **27**: *Pseudofusulinella* sp., D2-022979, It-8, ×15.

assignment to *Semistaffella* might be not denied, are distinguished in It-5 without any association of age-diagnostic taxa. These two samples are provisionally thought to be late Bashkirian in age. Late Bashkirian fusulines illustrated in Kobayashi (2003) from sample It-9 are *Pseudostaffella praegorski* Rauser-Chernousova, 1949, *Eostaffella quasiampla* Sheng, 1958, and *Millerella* sp. Those in Kobayashi (2003) from M-21H are *Verella prolixa* (Sheng, 1958), *Millerella minuta* Sheng, 1958, and *Pseudostaffella*? sp.

A small pebble of sample It-10 contains *Fusulinella biconica* Hayasaka, 1924 [Fig. 4-13, 14]. Two specimens illustrated appear to other species of *Fusulinella* on account of abrasion of outer one or two whorls. That of M-21D contains *Kanmeraia itoi* (Y. Ozawa, 1925) [Fig. 4-8–10]. These two species are indices of the *Fusulinella biconica* Zone (Kashirian) and of the *Kanmeraia itoi* Zone (Podolskian), respectively in the Akiyoshi Limestone Group (T. Ozawa and Kobayashi, 1990). Accordingly, both pebbles are apparently assigned the middle Moscovian. *Parastaffelloides* sp. [Fig. 4-7] identical wth "*Staffella pseudosphaeroidea* Dutkevich, 1934" described from the Moscovian of the Yayamadake Limestone by Kanmera (1954) is associated with *Fusulinella biconica* in It-10

Although well-oriented specimens were not obtained, primitive schwagerinids are abundant in It-11 (fusuline packstone). Some of them [Fig. 4-11, 12, 29] are thought to be belonged to an evolved form of *Rauserites* and It-11 is probably early Gzhelian age taking the fusuline biostratigraphy of the Akiyoshi Limestone Group into account (unpublished data by the author). Many fusulinids most of which are identical with *Schwagerina krotowi* (Schellwien, 1908) [Fig. 4-15–17, 18?, 20, 21], are contained in It-20. *S. krotowi* is characteristic in the upper Asselian corresponding to the *Pseudoschwagerina miharanoensis – Paraschwagerina akiyoshiensis* Zone in the Akiyoshi Limestone Group.

Chalaroschwagerina vulgaris (Schellwien, 1909) [Fig. 4-19, 24] distinguished in sample It-8 (bioclastic packstone) and *Leeina kraffti* (Schellwien, 1909) [Fig. 4-23] in It-7 (fusuline grainstone) are index species of the Artinskian of the Akiyoshi Terrane (e.g, Toriyama, 1958; Nogami, 1961; T. Ozawa and Kobayashi, 1990). *Pseudofusulina fusiformis* (Schellwien, 1909) [Fig. 4-22], *Paraschwagerina*? sp. [Fig. 4-26] and *Pseudofusulinella* sp. [Fig. 4-27] are also contained in It-8. According to Skinner and Wilde (1965), *Pseudofusulinella* ranges from the Virgilian (Gzhelian) to the basal part of Leonardian (Artinskian and Kungurian) in northern California. Whereas, *Pseudofusulinella* from the lower Artinskian has not been reported from Asia and Europe except for the present material of the Miharaiyama area. Samples Y-2 with *Mesoschubertella*? sp. [Fig. 3-47], and M-21D with *Schubertella kingi* Dunbar and Skinner, 1937 [Fig. 3-48, 49] and *Pseudoendothyra* sp. [Fig. 4-1?6] are tentatively included in the Artinskian, though age-diagnostic schwagerinids are not accompanied to them.

The youngest limestone fragment, M-21C (weakly recrystallized limestone) exclusively contains *Neoschwagerina* sp. [Fig. 4-25, 28]. This unnamed species is thought to be an advanced form of the genus from the degree of development of transverse septula, suggesting late Wordian in age.

In summary, among 20 samples whose approximate age is determined or estimated, 14 belong to the Carboniferous and six to the Permian. Excluding four late Visean ones and two late Bashkirian ones originated from South China (Kobayashi, 2003), remaining 14 are thought to have been certainly derived from the limestone blocks of the Akiyoshi Terrane taking close similarities of litho- and bio-facies of limestone into consideration. Late Visean ones are possibly thought to have been derived from the Akiyoshi Terrane. However, conclusion is postponed, since taxonomic reexamination of foraminifers in the lower and basal parts of the Akiyoshi Limestone Group by the author is now in progress.

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兵庫県養父市御祓山地域のペルム系舞鶴層群の石灰岩礫岩から産する先キャピタニアン（先ペルム紀中期後葉）有孔虫類 —兵庫県産古生代後期・中生代前期有孔虫類，その 14—

小 林 文 夫

兵庫県養父市御祓山地域の石灰岩礫岩の転石に含まれる石灰岩の細礫～中礫 32 サンプルから先キャピタニアンの有孔虫類が識別された．これらの石灰岩片は砂質基質の礫岩に密または疎に産し，*Lepidolina kumaensis* 化石群を産する石灰質な泥質基質のものとは異なる．それらはペルム系舞鶴層群中部層に由来すると考えられる．有孔虫群集の組成から，下部三畳系夜久野層群の基底礫岩（舞鶴層群を傾斜不整合に被う）由来と以前考えられた 2 サンプルを含め，これら 20 ンプルのおおまかな地質年代は決定・類推される．それらはビゼアン後期，サープホビアン後期～バシキリアン前期，バシキリアン後期，モスコビアン中期，グゼーリアン前期，アゼリアン後期，アーティンスキアン，ワーディアン後期の 8 つの年代グループにまとめられる．

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