Foraminifera of the Miocene Sakuma Formation, Japan

(Microbiostratigraphic study of the Cainozoic Strata of Japan, Series II)

By

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The Sakuma formation mainly consisting of alternating thin sandstones and mudstones with intercalary small lentils of shell sand is very well exposed on the shore between Yoshihama¹⁾ and Kamegasaki,²⁾ south of Hota, in Bōsō Peninsula, Chiba Prefecture (Fig. 1).

Fig. 1. The localities and the columnar section of the Sakuma formation, exposed on the shore between Yoshihama and Kamegasaki, south of Hota in Bōsō Peninsula.

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It is inferred from the occurrence of *Lepidocyclina makiyamai* Morishima, *L. ikebei* Morishima (MS) and *Miogypsina kotoi* Hanzawa that the Sakuma is the uppermost part of the middle Miocene or the F₃ stage of the Japonic Neogene.

The present work is a part of the fundamental study aiming at establishment of microbiostratigraphy of the Cainozoic strata in Kantô region. The fossil micro-organisms collected by N. Ikebe, M. Morishima and K. Nakaseko from the above-mentioned section are under examination. 18 composite samples of 50 grams collected at random from the rocks of about 10m in thickness in succession were washed, and number of every micro-form counted.

Unfortunately, owing to that only a small part of the whole Sakuma is represented in this section and the individual number of each species is by no means rich, a more definite minor biostratigraphic zoning was impossible.

A foraminiferal faunule characterized by larger forms such as *Lepidocyclina* and *Miogypsina*, in addition to smaller genera in 54 species is distinguished.¹⁾ Generally speaking, this faunule may be characterized also by the abundance of Miliolidae, Lagenidae, Rotalidae and Amphisteginidae (Table).

Amphistegina radiata (Fichtel et Moll) showing the shallow warmer water occurs abundantly in all part of the section. *Quinqueloculina vulgaris* d'Orbigny and *Q. seminulum* (Linné) are rather common. According to Norton, the latter species is consistently found in deeper waters, but its occurrence does not show the depth of the deposits as many records from shallower waters are at hand, while the former is a form of the shallow seas of Pacific. *Robulus limbosus* (Reuss) which seems to be fairly common in Pacific Ocean is commonly met with. *Eponides haidengeri* (d'Orbigny) and *E. sp.* (ks 5) are very abundantly found. *Eopnides sp.* (ks 5) closely resembles to *Epistomina elegans* (d'Orbigny) in its outline, but has no supplementary aperture, which is characteristic to the latter. These species have a wide distribution. *Rotalia ikebei* n. sp. is one of the common forms. This species is similar to *Rotalia nipponica* Asano which is generally confined to the shallow waters to the Pacific side of Japan. The occurrence of *Rotalia mulutispinosa* Nakamura, whose type has been recorded from the Byoritu Bed in Formosa, shows the Indo-Pacific character of this faunule. *Cassidulina pacifica* Cushman is also common. It is common in the Tertiary rocks on the Pacific sides of Japan, as well as living. *Cibicides refulgens* (Montfort) is also very abundant. This species has a wide distribution and is not much confined to any depth or temperature. Buliminidae is very scarce.

1) Descriptions of these larger forms are now in preparation by M. Morishima.

Stratigraphic distribution of Foraminifera in the Sakuma formation
between Yoshihama and Kamegasaki, south of Hota in Bōsō Peninsula

	C 10192	C 10194	C 10195	C 10196	C 10197	C 10198	C 10199	C 10200	C 10201	C 10202	C 10203	C 10205	C 10191	C 10190	C 10189	C 10187
<i>Ammodiscus</i> ks 1															2	
<i>Cyclammina</i> ks 1								3	1				1			
<i>C.</i> ks 2			1													
<i>C.</i> ks 3			1						1							
<i>C.</i> ks 4										1						
<i>C.</i> ks 5															1	
<i>C.</i> ks 6															1	
<i>Quinqueloculina vulgaris</i> d'Orbigny				1		2	3						5	2		
<i>Q. seminulum</i> (Linne)	1				1	1	1						13		1	1
<i>Q.</i> spp.					1		2				1			1	4	4
<i>Spiroloculina</i> spp.															2	
<i>Triloculina tricarinata</i> d'Orbigny											1					
<i>T. circularis</i> Borneman											1					
<i>Pyrgo anomala</i> (Schumberger)						1							1			
<i>P. denticulata</i> (Brady)											1					
<i>Robulus limbosus</i> (Reuss)		2			2	1		1	2			2		2		1
<i>R. cf. limbosus</i> (Reuss)							1									
<i>Lenticulina morishimai</i> n. sp.		2						1		1						
<i>L. kamakuraensis</i> Asano					1											
<i>Dentalina</i> sp.								1								
<i>Nodosaria insecta</i> Schwager														2	1	1
<i>Lagenonodosaria scalaris</i> Asano		1					1									
<i>L. scalaris sagamiensis</i> Asano															2	
<i>Vaginulina yoshihamaensis</i> n. sp.		5	1		2	2		2						2		
<i>Nonion umbilicatum</i> (Walker et Jacob)							1									
<i>N. japonica</i> Asano														1		1
<i>Elphidium crispum</i> (Linné)															7	
<i>E. cf. chapmani</i> Cushman		1														
<i>Bolivina cf. robusta</i> H. B. Brady		6											1			
<i>B. cf. hebes</i> Maciadyen														1		
<i>Reussella spinulosa</i> (Reuss)		3				1	3									
<i>Angulogerina</i> ks 1		4													1	
<i>Trifarina bradyi</i> Cushman															1	
<i>Discorbis vilardevoana</i> d'Orbigny							1									
<i>D. araucana</i> d'Orbigny						1	2						3			
<i>D.</i> ks 3						1										
<i>Eponides umbonatus</i> (Reuss)						1									1	
<i>E. repandus</i> (Fichtel et Moll)							1	1								
<i>E. karsteni</i> (Reuss)													2			
<i>E. haidengeri</i> (d'Orbigny)		39	6	1		6	4	2	1				2		3	1
<i>E.</i> ks 5	1		1			10	3					1	3	4		
<i>Rotalia ikebei</i> n. sp.		9					8	2					3	4	1	2
<i>R. multispinulosa</i> Nakamura		3	1			1										
<i>R.</i> spp.		1					1									
<i>Amphistegina radiata</i> (Fichtel et Moll)	1	10			2	3	3		5	1	1		2	3	1	
<i>Cassidulina pacifica</i> Cushman		18				3	5						9	1		
<i>C.</i> aff. <i>kazusaensis</i> Asano		4				2										
<i>Cibicides refulgens</i> (Montofort)	1	77	3			40	44	14	1		1		2		14	16
<i>C. pseudoungerianus</i> Cushman		9		1		3		1					2			
<i>C. wuellerstorfi</i> Schwager		6			1	2	3						1		2	2
<i>C.</i> ks 2		4											1			
<i>Globigerina</i> spp.							2	1			1		2	1	4	

Judging from the above criteria, the Sakuma formation is considered to be deposited under the shallow and warm water.

In conclusion, the writers wish to express their most sincere gratitude to Prof. Jiro Makiyama, Prof. Nobuo Ikebe and Mr. Masao Morishima for the valuable guidance in this work.

Description of New Species

Lenticulina morishimai n. sp. (Fig. 3)

Test much compressed, usually somewhat longer than broad, periphery subacute; chambers distinct, later chambers increasing markedly in length, 9 to 10 in the last formed coil, earlier coils visible; sutures distinct, broad and limbate, very slightly depressed, strongly curved; wall smooth; aperture radiate. Length 1 mm; width 0.8 mm; thickness 0.4 mm.

Holotype from the Sakuma formation at Yoshihama-mura (Loc. C 10202).

This species is very similar to *L. relizensis* Kleinpell but differs in its much more strongly curved sutures.

Fig. 2. *Vaginulina yoshihamaensis* n. sp. $\times 32$

Fig. 3a, 3b. *Lenticulina morishimai* n. sp. $\times 32$

Fig. 4a, 4b, 4c. *Rotalia ikebei* n. sp. $\times 75$

Vaginulina yoshihamaensis n. sp. (Fig. 2)

Test elongate, gradually increasing in diameter toward apertural end, the first few chambers closely coiled, the later ones becoming uncoiled, initial end round, peripheral margin acute but not keeled; chambers 13 or more, sutures distinct, limbated, slightly depressed; aperture unknown. Length over 1 mm.

Holotype from the Sakuma formation at Yoshihama-mura (Loc. C 10190).

This species differs from *Vaginulina boso* Asano in having the more closely coiled chambers in the initial end.

Unfortunately, the holotype and all the other specimens at hand have broken apertural ends.

Rotalia ikebei n. sp. (Fig. 4)

Test biconvex, ventral side more convex, composed of about three convolutions, of which the last-formed coil consists of about ten chambers, peripheral margin sharply round, sutures distinct, flush or slightly depressed on dorsal sides, slightly curved on ventral side; umbilical area having a conical plug; wall smooth; aperture narrow in ventral side. Diameter up to 0.4 mm; thickness up to 0.4 mm.

Holotype from the Sakuma formation Yoshihama-mura (Loc. C 10190).

This species is easily distinguished from *Rotalia nipponica* Asano in having the round peripheral margin and the higher test.

短

報

湊 秀雄・村岡久志・新岡暢一：埼玉縣秩父鑛山大黒坑及び六助坑産硫砒鐵鑛の結晶形態

埼玉縣秩父郡大瀧村秩父鑛山及びその附近は多種類の鑛物を産出し、舊くより多くの報告があり、此處で更めて擧げ得ない程である。數年前同鑛山の鑛物産狀を見學に行つた際、大黒坑及び六助坑より結晶の美麗な硫砒鐵鑛 (arsenopyrite, FeAsS) の試料を採集し得た。今回此を測角し、正確な形態を決定し得たのでその結果を報告する。

今回此を測角し、正確な形態を決定し得たのでその結果を報告する。

A) 大黒坑産硫砒鐵鑛の結晶形態：此の鑛體は主として石灰岩が交代されて生じた石閃亞鐵鑛を主とする鉛・亞鉛の鑛床であるが、最近閃亞鉛鑛に伴つて黃銅鑛・自然金・硫砒鐵鑛等の産出が知られて來た。硫砒鐵鑛は鑛床中數ヶ處に不規則な小塊狀として存在するものの様で、黃鐵

第1圖 秩父鑛山大黒坑産硫砒鐵鑛双晶結晶圖

第2圖 秩父鑛山大黒坑産硫砒鐵鑛双晶結晶圖

鑛の塊狀體の中等に見られ小結晶が集合して塊狀をなしている。結晶は大きさ約5 mm位の短柱狀であり、淡黃色金屬光澤を呈するが、ほとんどすべてのものが貫入双晶である。双晶面は $e(101)$ 面であり、2 結晶體の相互關係により1, 2, 3圖が得られるが1, 2圖と3圖との關係は裏表であつて、第4圖により説明され得