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GEOLOGICAL SURVEY OF JAPAN

Katsu KANEKO, Director

Upper Cretaceous Foraminifera from the Rumoi Coal Field, Hokkaidō, Japan

By

Osamu FUKUTA

On the Myophorians from the Miharai-yama Group in Hyōgo Prefecture

By

Nobukazu KAMBE

GEOLOGICAL SURVEY OF JAPAN

Hisamoto-chō, Kawasaki-shi, Japan

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Abstract

Recently, the distribution of the upper Cretaceous rocks in the eastern part of the Rumoi coal field was exactly clarified by the members of Coal Section, Fuel Department, Geological Survey of Japan. These strata consist mostly of dark gray mudstones intercalating many thin liparitic tuff layers. They carry many Foraminifera at two localities. Thirty forms are detected. Two species are described as new. These fossils appear to indicate a rather uniform environment of temperate waters at infraneritic or bathyal depth. The fauna correlates with that of the Navarro or Taylor groups of the Gulf Coastal Region of the United States and with that of the Futaba group of the Jōban coal field of Japan. Therefore, the age of the strata containing these fossils is Campanian of the European Standard for the most part.

Introduction

The materials treated in this paper were collected by Mr. M. Sogabe and the writer in 1955 through the geological survey of the Rumoi coal field, Hokkaidō. Only two of many rock samples collected from the upper Cretaceous sediments contain many tests of the smaller Foraminifera. In this paper, the writer gives short description of them.

Previous Works on the Upper Cretaceous Smaller Foraminifera from Japan

Very little has been published on the upper Cretaceous smaller Foraminifera from Japan. Fifteen species with characteristic upper Cretaceous species of *Globotruncana* and *Silicosigmoilina* were recorded by Dr. K. Asano in 1949 (published in 1950) from the Futaba group of the Jōban coal field in Fukushima prefecture, Honshū. In the same year, Mr. S. Imanishi collected *Silicosigmoilina futabaensis* Asano at Utsunai, Nakatombetsu-mura, Esashi-gun, Kitami Province, Hokkaidō (Asano, K., 1950 b). This species is originally

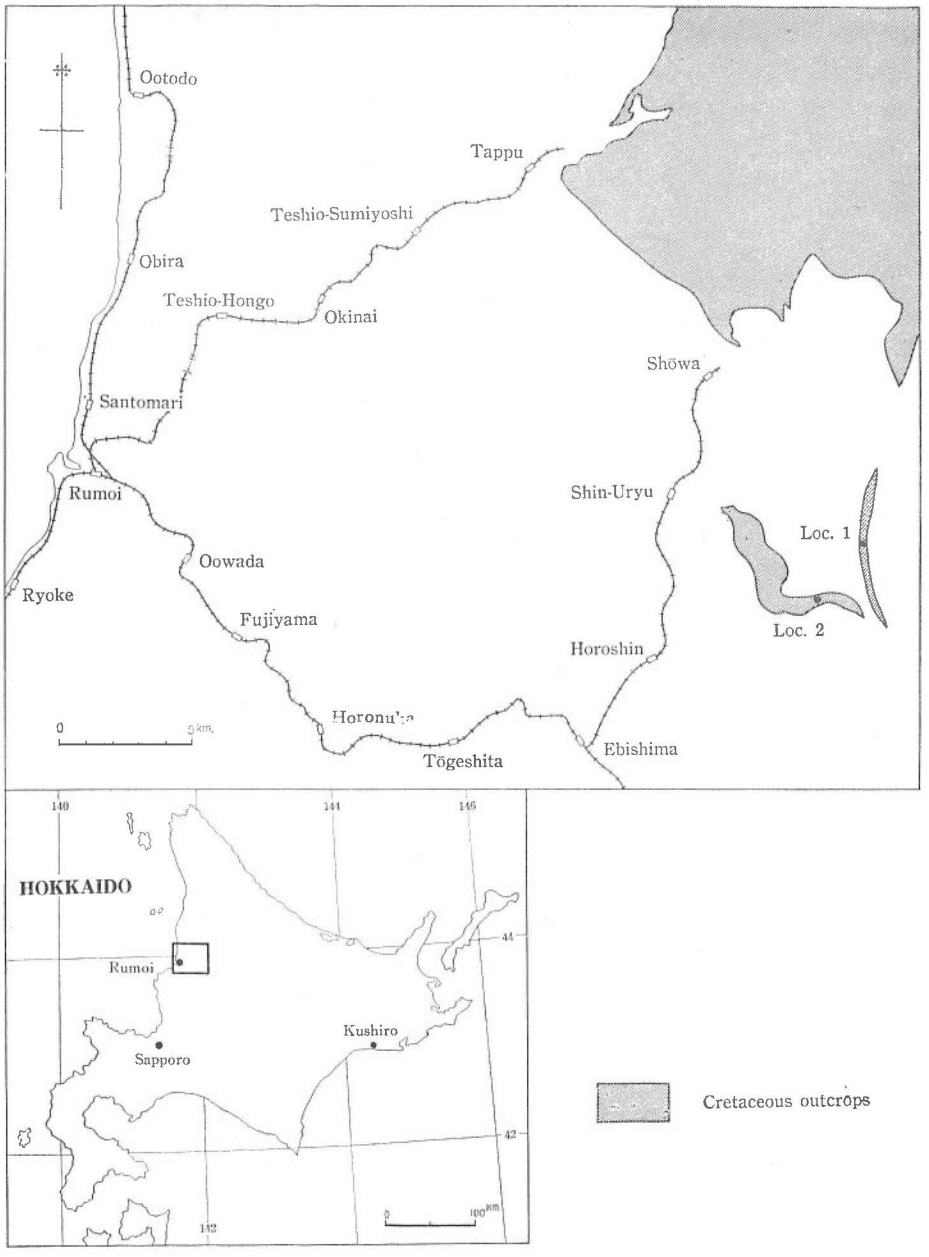

Fig. 1. Map showing the Location of the Samples

described from the upper Cretaceous of the Jōban coal field (Asano, K., 1950 a). Twenty-two species with *Globotruncana canaliculata* (Reuss), one of the most characteristic species of the upper Cretaceous of Europe and America, were reported by Dr. K. Asano in 1950 from the upper Cretaceous sediments of Nakagawa-mura, Nakagawa-gun, Teshio Province, Hokkaidō.

Geological Notes

Since many years ago, it has been known that the upper Cretaceous rocks are widely distributed in the northeastward area of the Rumoi coal field (Matsumoto, T., 1942; 1953 b). Recently, the distribution of the upper Cretaceous rocks in the eastern part of this coal field was exactly clarified by the members of Coal Section, Fuel Department, Geological Survey of Japan.

The upper Cretaceous rocks of the latter are distributed in separated two blocks. The rocks are mostly dark gray mudstones intercalating many thin liparitic tuff layers. Partly, the mudstones intercalate thin fine or medium grained sandstone layers. A few specimens of *Inocerami* and Ammonites are collected from these rocks.

The Location of the Samples

The rock samples containing many tests of the smaller Foraminifera under consideration were collected by M. Sogabe and the writer also from the upper Cretaceous rocks at two localities, both situated in Kōshin Dai-san-ku, Numata-machi, Uryū-gun, Sorachi Province, Hokkaidō. (see fig. 1)

The location and the collectors of the samples are as follows:

Loc. no.	Location	Collector
Loc. 1	43° 53′ 41″ N 141° 59′ 46″ E	O. Fukuta
Loc. 2	43° 54′ 58″ N 142° 1′ 10″ E	M. Sogabe

Foraminifera and Other Microfossils

The Foraminifera and other microfossils were picked up from the random samples of about 80 g in weight. They are shown in table 1. As shown in this table, thirty forms are detected, two of which are described and figured as new.

Table 1. Foraminifera and Other Microfossils

Species \ Localities	Loc. 1	Loc. 2
Foraminifera		
1. *Rhabdammina* sp.		2*
2. *Bathysiphon* cf. *alexanderi* Cushman	1*	
3. *B.* sp.	1	3
4. *B.* ? sp.		1
5. *Haplophragmoides glabra* Cushman and Waters		2
6. *H.* cf. *ijimai* Asano	2	
7. *H.* sp. 1		1
8. *H.* sp. 2		1
9. "*Pseudoclavulina*" sp.		1
10. *Trochammina* sp.	1	
11. Arenaceous Foraminifera, gen. and sp. indet.	14	4
12. *Rzehakina sogabei* n. sp.	4	1
13. *R.* *uryuensis* n. sp.	15	6
14. *Silicosigmoilina futabaensis* Asano	8	10
15. *Robulus* cf. *aldrichi* Sandidge	1	
16. *R.* cf. *discrepans* (Reuss)	1	
17. *R. spisso-costata* Cushman var.	1	
18. *Lenticulina rotulata* Lamarck	2	
19. *Marginulina curvatula* Cushman	1	
20. *Dentalina* cf. *catenula* Reuss	1	
21. *D.* cf. *consobrina* d'Orbigny		1
22. *D.* cf. *stephensoni* (Cushman)	1	
23. *Frondicularia* sp. 1	1	
24. *F.* sp. 2	1	
25. *F.* sp. 3	1	
26. *Globulina lacrima* Reuss	2	
27. Globigerinidae ?, gen. and sp. indet.	1	
28. *Globotruncana* sp.	2	
29. *Planulina* cf. *dumblei* (Applin)	2	
30. *Cibicides* cf. *coonensis* (W. Berry)	2	
31. *C.* ? sp.		1
Total	66	34
Other Microfossils		
Radiolaria	7	
Bryozoa	2	
Ostracoda	1	
Echinoidal spines	50	5

* Numbers of individuals in the random samples of about 80 g in weight

Paleoecology

It would be manifestly suspect to attempt precise ecologic interpretations from a fauna in which all of the species and even a few of the genera are extinct. There are possibly some criteria which might be indicative of the general conditions, however.

These criteria are based upon dominance or abundance of Silicinidae and arenaceous Foraminifera in the faunas. Percentage-abundance counts of these groups to all foraminiferal faunas are shown in table 2. Such features are also found in the Miocene black shales of the oil fields of the Coastal Region of Sea of Japan.

Table 2. Percentage-Abundance Counts of Arenaceous Foraminifera and Silicinidae

Groups \ Localities	Loc. 1	Loc. 2
Arenaceous Foraminifera	29	44
Silicinidae	41	50

There are no essential differences between the faunas of the above-mentioned two localities. In addition, many species of the family Lagenidae are found in the fauna from Loc. 1. Of these species, *Robulus spisso-costata* Cushman var. is characterized by its sutures which are limbate and strongly raised, becoming thick and rounded toward the inner end and covering the umbo. Such features are not found in the cool or cold water forms. Then, these faunas appear to indicate a rather uniform environment of temperate waters at infraneritic or bathyal depth.

Age Considerations

A comparison of these foraminiferal faunas with that of the Futaba group reveals dominance of Silicinidae common to both areas. Especially, *Silicosigmoilina futabaensis* Asano is dominant in Loc. 2. This species is one of the characteristic species in the fauna of the Futaba group. Then, the upper Cretaceous rocks containing these faunas are correlated with the Futaba group.

Table 3 shows the reported ranges of both the identified and confered

Table 3. Reported Ranges of Both the Identified and Confered Species

European Standard	Maestrichtian	Campanian	Santonian	Coniacian	Turonian	Cenomanian
Gulf Coastal Region of the United States	Navarro	Taylor		Austin	Eagle-Ford	Woodbine
Bathysiphon alexanderi Cushman				———		
Haplophragmoides glabra Cushman and Waters	———					
Robulus aldrichi Sandidge	———					
R. discrepans (Reuss)	Details unknown					
R. spisso-costata Cushman	———					
Lenticulina rotulata Lamarck		———				
Marginulina curvatula Cushman	———					
Dentalina catenula Reuss		———				
D. consobrina d'Orbigny	———					
D. stephensoni (Cushman)	———					
Globulina lacrima Reuss	———					
Planulina dumblei (Applin)		———				
Cibicides coonensis (W. Berry)	———					

Japan	Hetonaian	Urakawan	Gyliakian
Haplophragmoides ijimai Asano			———
Silicosigmoilina futabaensis Asano		Details unknown	

species. As shown in this table, above faunas of the Rumoi coal field contain twelve species which are identified and confered to the upper Cretaceous species of the Gulf Coastal Region of the United States. Ten, seven and four species of them are in the Navarro, Taylor and Austin groups of the latter respectively. Therefore, the upper Cretaceous rocks of the Rumoi coal field are correlated with the Navarro or Taylor groups. In view of the foregoing considerations and the fact that the Taylor and Navarro groups are generally correlated with the Santonian, Companian and Maestrichtian of the European Standard (Matsumoto, T., 1953 a), the upper Cretaceous rocks of the Rumoi coal field are considered to be Companian in age for the most part.

Systematic Descriptions

Order FORAMINIFERA

Family ASTRORHIZIDAE

Genus RHABDAMMINA M. Sars, 1869

Rhabdammina sp.

The fragmentary specimens in the present collection do not warrant description.

Family RHIZAMMINIDAE

Genus BATHYSIPHON M. Sars, 1872

Bathysiphon cf. *alexanderi* Cushman

(Plate 1, Figure 1)

Bathysiphon alexanderi Cushman, 1933, Cushman Lab. Foram. Res., Vol. 9, p. 49, pl. 5, fig. 1.

Bathysiphon alexanderi Cushman, 1946, U. S. Geol. Surv. Prof. Paper 206, p. 14, pl. 1, fig. 5.

Bathysiphon alexanderi Frizzell, 1954, Bureau Econ. Geol., Univ. Texas, Rep. Invest., No. 22, p. 56, pl. 1, fig. 1.

The single fragmentary specimen in the present collection is similar to that figured by Cushman from the Brownstown marl, Red River Country, Texas. Length and breadth of the specimen are 0.63 mm and 0.38 mm respectively.

Bathysiphon sp.

The fragmentary and compressed specimens in the present collection do not warrant description.

Bathysiphon? sp.

Exact determination of genus of the single fragmentary specimen in the present collection is difficult.

Family LITUOLIDAE

Genus HAPLOPHRAGMOIDES Cushman, 1910

Haplophragmoides glabra Cushman and Waters

(Plate 1, Figure 2)

Haplophragmoides glabra Cushman and Waters, 1927, Cushman Lab. Foram. Res. Contr., Vol. 2, pl. 4, p. 83, pl. 10, figs. 6 a, b.

Haplophragmoides glabra Cushman, 1946, U. S. Geol. Surv. Prof. Paper, 206, p. 20, pl. 2, figs. 16, 17.

Haplophragmoides glaber Frizzell, 1954, Bureau Econ. Geol., Univ. Texas, Rep. Invest., No. 22, p. 60, pl. 1, figs. 31 a, b.

The distorted specimens in the present collection are very similar to those figured by Cushman and Waters in their general features. Diameter and thickness of the figured specimen are 0.55 mm and 0.27 mm respectively.

This species seems to be characteristic of the Navarro group.

Haplophragmoides cf. *ijimai* Asano

(Plate 1, Figure 3)

Haplophragmoides ijimai Asano, 1950, Short Papers IGPS, No. 2, p. 17–18, pl. 3, figs. 11 a, b.

"Test close-coiled, planispiral, slightly compressed, umbilicate, periphery broadly rounded; chambers 5 or 6 in the last coil; sutures nearly radial, depressed; wall finely arenaceous, smoothly finished; aperture indistinct. Diameter up to 0.7 mm."—Asano, K., 1950 b.

The types of this species are from the Saku mudstone of the Upper Gyliakian (≒Turonian) stage at the valley-cliffs along the Gakkō-sawa, Nakagawa-mura, Nakagawa-gun, Teshio Province, Hokkaidō.

The present specimens are slightly distorted, and are somewhat smaller than the typical forms. Diameter of the figured specimen is 0.36 mm.

Haplophragmoides sp. 1

(Plate 1, Figure 4)

The highly distorted specimen in the present collection shows the following features:

"Test globular, closely coiled, completely involute, periphery very broadly rounded; chambers 6?, inflated; sutures distinct, nearly radial, depressed; wall finely arenaceous, smoothly finished; aperture indistinct. Diameter is 0.57 mm."

The specimen is possibly new species, but the further material is needed for the specific evaluation.

Haplophragmoides sp. 2

The single specimen is possibly new species, but the further material is needed for the specific evaluation. The specimen has much compressed test and subacute periphery. Diameter and thickness of the specimen are 0.41 mm and 0.14 mm respectively.

Family VERNEUILINIDAE

Genus PSEUDOCLAVULINA Cushman, 1936

"Pseudoclavulina" sp.

The single fragmentary specimen in the present collection is similar to the uniserial part of some species of the genus *Pseudoclavulina,* for example, *P. chitinosa* (Cushman and Jarvis). Length and breadth of the specimen are 0.46 mm and 0.33 mm respectively.

Family TROCHAMMINIDAE

Genus TROCHAMMINA Parker and Jones, 1859

Trochammina sp.

The single specimen in the present collection is highly deformed, and does not warrant description.

Family SILICINIDAE

Genus RZEHAKINA Cushman, 1921

Rzehakina sogabei n. sp.

(Plate 1, Figures 5 a-b)

Test much compressed, obliquely oval in side view, periphery subacute;

chambers low, phanispiral, each forming a half coil; sutures indistinct; wall finely arenaceous, firmly cemented with siliceous cement; aperture narrow, constricted, without a tooth; white or light gray in color. Length 0.66 mm, breadth 0.49mm and thickness 0.11 mm in holotype.

Holotype: CF57005

This species differs from all known species of this genus in its obliquely oval test.

Rzehakina uryuensis n. sp.

(Plate 1, Figures 6 a-c)

Test much compressed, oval in side view, periphery subacute; chambers low, planispiral, each forming a half coil; sutures indistinct; wall finely arenaceous, firmly cemented with siliceous cement; aperture narrow, constricted, without a tooth; white or light gray in color. Length 0.68 mm, breadth 0.46 mm and thickness 0.11 mm in holotype.

Holotype: CF57006

This species is very similar to *Rzehakina epigona* (Rzehak), but differs from the latter in its more compressed test. This species is also similar to *R. epigona* var. *lata* Cushman and Jarvis, but the last coil of the latter shows much more prominent appearance. *R. epigona* var. *minima* Cushman and Renz differs from this species in its much smaller size, very much compressed test and clear chambers.

Genus SILICOSIGMOILINA Cushman and Church, 1929

Silicosigmoilina futabaensis Asano

(Plate 1, Figures 7 a-b, 8)

Silicosigmoilina futabaensis Asano, 1950, Pacific Science, Vol. 4, p. 159, pl. 1, figs. 6, 7.

"Test compressed, oval in side view, periphery subacute; chambers planispiral in earlier and sigmoidal in the later stages; sutures indistinct, but fairly well marked between later chambers, not deeply depressed; wall finely arenaceous, firmly cemented with siliceous cement; aperture simple, without a tooth; white or light gray in color. Length 0.7 mm; breadth 0.3-0.5 mm; thickness 0.2-0.3 mm"—Asano, K., 1950 a.

According to Asano, this species is related to *Silicosigmoilina californica* Cushman and Church, a species found abundantly in the upper Cretaceous

of California, but the Japanese species has a more compressed test. The types are from a test well located at Yokouchi, Hisanohama-machi, Futaba-gun, Fukushima prefecture. The presence of the upper Cretaceous rocks in this general area was already known from the work of Tokunaga, S. and Shimizu, S. (1926), who recorded *Trigonia*, *Inoceramus* and ammonites, indicative of Senonian age.

The present specimens are very variable in size and outline, but they are similar to those figured by Asano.

Family LAGENIDAE

Genus ROBULUS Montfort, 1808

Robulus cf. *aldrichi* Sandidge

(Plate 1, Figure 9)

Robulus aldrichi Sandidge, 1932, Jour. Paleont., Vol. 6, p. 272, pl. 42, figs. 3, 4.

Robulus aldrichi Cushman, 1946, U. S. Geol. Surv. Prof. Paper 206, p. 55, pl. 18, figs. 10 a, b.

The test of the single specimen in the present collection is more compressed than the typical forms. Diameter of the specimen is 0.46 mm.

The types of this species are from the Ripley formation of Alabama, United States.

Robulus cf. *discrepans* (Reuss)

(Plate 1, Figure 10)

Robulina discrepans Reuss, 1863, Akad. Wiss. Wien, Math.-naturwiss, kl., Sitzungsber., Vol. 46, p. 78, pl. 9, figs. 7 a, b.

Robulus discrepans Cushman and Jarvis, 1932, U. S. Nat. Mus. Proc., Vol. 80, art. 14, p. 23, pl. 7, figs. 4 a, b.

Robulus discrepans Cushman, 1946, U. S. Geol. Surv. Prof. Paper 206, p. 54, pl. 17, fig. 15.

The single specimen in the present collection is referred to those figured by Cushman and Jarvis from the upper Cretaceous of southeastern Trinidad, but the inadequate material makes positive identification difficult. Diameter of the specimen is 0.58 mm.

Robulus spisso-costata Cushman var.

(Plate 1, Figure 11)

Robulus spisso-costata Cushman, 1938, Cushman Lab. Foram. Res. Contr.,

Vol. 14, p. 32, pl. 5, fig. 2.

Robulus spisso-costata Cushman, 1946, U. S. Geol. Surv. Prof. Paper 206, p. 52-53, pl. 16, figs. 11-14; pl. 17, fig. 1.

Robulus spisso-costatus Frizzell, 1954, Bureau Econ. Geol., Univ. Texas, Rep. Invest., No. 22, p. 81, pl. 8, figs. 9 a, b.

The present specimen differs from the typical forms in its large spine. Diameter of the specimen is 0.86 mm.

The types of the variety are from the Corsicana marl of the Navarro group, Limestone Country, Texas. This species is characteristic of the upper part of the Navarro group above the Nacatoch sand.

Genus Lenticulina Lamarck, 1804

Lenticulina rotulata Lamarck

(Plate 1, Figure 12)

? *Lenticulites rotulata* Lamarck, 1804, Mus. Nat. d'Hist. Natur, Ann. 5, p. 188.

Cristellaria rotulata Carsey, 1926, Texas Univ. Bull. 2612, p. 39, pl. 6, fig. 2.

Lenticulina rotulata Plummer, 1931, Texas Univ. Bull. 3101, p. 142, pl. 11, fig. 20.

Lenticulina rotulata Cushman, 1946, U. S. Geol. Surv. Prof. Paper 206, p. 56-57, pl. 18, fig. 19; pl. 19, figs. 1-7.

Lenticulina rotulata Frizzell, 1954, Bureau Econ. Geol., Univ. Texas, Rep. Invest., No. 22, p. 82, pl. 8, fig. 14.

Very many forms have been referred to Lamarck's species. Umbones of the specimens in the present collection are not so distinct as those of the typical forms. Length, breadth and thickness of the figured specimen are 0.63 mm, 0.49 mm, and 0.33 mm respectively.

This species is recorded from the upper Cretaceous of the Gulf Coastal Region of the United States.

Genus Marginulina d'Orbigny, 1826

Marginulina curvatula Cushman

(Plate 1, Figure 13)

Marginulina curvatula Cushman, 1938, Cushman Lab. Foram. Res. Contr., Vol. 14, p. 34, pl. 5, figs. 13, 14.

Marginulina curvatula Cushman, 1946, U. S. Geol. Surv. Prof. Paper 206,

p. 63, pl. 22, figs. 11–14.

Marginulina curvatula Frizzell, 1954, Bureau Econ. Geol., Univ. Texas, Rep. Invest., No. 22, p. 84, pl. 8, figs. 40, 41.

The single specimen in the present collection may not be adult. The inflated chambers, which are nearly circular in transverse section, and the radiate aperture at peripheral angle are the characteristic features of this species. Length of the specimen is 0.66 mm.

The types of this species are from the Corsicana marl of Texas. It also occurs in the Arkadelphia marl of Arkansus. Both marls are of Navarro age, upper Cretaceous.

Genus DENTALINA d'Orbigny, 1826

Dentalina cf. *catenula* Reuss

(Plate 1, Figure 14)

Dentalina catenula Reuss, 1860, Akad. Wiss. Wien, Math.-naturwiss. kl., Sitzungsber., Vol. 40, p. 185, pl. 3, fig. 6.

Dentalina catenula Cushman, 1946, U. S. Geol. Surv. Prof. Paper 206, p. 67–68, pl. 23, figs. 27–32.

Dentalina catenula Frizzell, 1954, Bureau Econ. Geol., Univ. Texas, Rep. Invest., No. 22, p. 87, pl. 9, figs. 35–37.

The single fragmentary specimen in the present collection is represented by initial chamber, and is similar to some of those figured by Cushman from the Pecan Gap chalk member of the Taylor marl, McLennan County, Texas. Diameter of the specimen is 0.39 mm.

The types of this species are from the upper Cretaceous of Westphalia, Germany. In the Gulf Coastal Region of the United States, the species is widely distributed and confined to the middle and upper beds of Taylor age, with occassional specimens in the Neylandville marl of the lower part of the Navarro group.

Dentalina cf. *consobrina* d'Orbigny

(Plate 1, Figure 15)

Dentalina consobrina d'Orbigny, 1846, Foraminiferes fossiles du bassin tertiare de Vienné (Autriche), p. 46, pl. 2, figs. 1–3.

Dentalina cf. *consobrina* Cushman, 1946, U. S. Geol. Surv. Prof. Paper 206,

p. 69–70, pl. 24, figs. 23–27.

Dentalina sp. cf. *D. consobrina* Frizzell, 1954, Bureau Econ. Geol., Univ. Texas, Rep. Invest., No. 22, p. 87, pl. 9, fig. 38.

The single fragmentary specimen in the present collection is identified with *Dentalina* cf. *consobrina* figured by Cushman from the Ripley formation of Tennessee. Length and breadth of the specimen are 0.48 mm and 0.11 mm respectively.

This species occurs in the Navarro and Taylor groups of the Gulf Coastal Region of the United States.

Dentalina cf. *stephensoni* (Cushman)

(Plate 1, Figure 16)

Ellipsonodosaria stephensoni Cushman, 1936, Cushman Lab. Foram. Res. Contr., Vol. 12, p. 52, pl. 9, figs. 10–15.

Ellipsonodosaria stephensoni Cushman, 1946, U. S. Geol. Surv. Prof. Paper 206, p. 134, pl. 56, figs. 2–7.

Dentalina stephensoni Bandy, 1951, Jour. Paleont., Vol. 25, p. 501, pl. 73, figs. 10, 11.

Ellipsonodosaria stephensoni Frizzell, 1954, Bureau Econ. Geol., Univ. Texas, Rep. Invest., No. 22, p. 121, pl. 18, figs. 22–23.

The single fragmentary specimen in the present collection is similar to those figured by Bandy from the upper Cretaceous of the Carlsbad Area, San Diego County, California. Length and breadth of the specimen are 0.58 mm and 0.16 mm respectively.

According to Bandy, numerous specimens were examined in order to determine the character of the aperture, but a definite tooth was found in none.

Genus FRONDICULARIA Defrance, 1824

Frondicularia sp. 1

(Plate 1, Figure 17)

The single fragmentary specimen in the present collection does not warrant description. Length and breadth of the specimen are 0.60 mm and 0.30 mm respectively.

Frondicularia sp. 2

(Plate 1, Figure 18)

The single fragmentary specimen in the present collection does not warrant description. Length and breadth of the specimen are 0.50 mm and 0.44 mm respectively.

Frondicularia sp. 3

(Plate 1, Figure 19)

The single specimen, the upper part of which is broken, is possibly new species, but the further material is needed for specific evaluation. Length and breadth of the specimen are 0.47 mm and 0.35 mm respectively.

Family POLYMORPHINIDAE

Genus GLOBULINA d'Orbigny, 1839

Globulina lacrima (Reuss)

(Plate 1, Figure 20)

Polymorphina (*Globulina*) *lacrima* Reuss, 1845, Verstein. böhm. Kreideformation, pt. 1, p. 40, pl. 12, fig. 6; pl. 13, fig. 83.

Globulina lacrima Cushman and Ozawa, 1930, U. S. Nat. Mus. Proc., Vol. 77, art. 6, p. 77, pl. 19, figs. 1, 2.

Globulina lacrima Cushman, 1946, U. S. Geol. Surv. Prof. Paper 206, p. 96, pl. 40, figs. 11, 12.

The definitely produced apertural end is a characteristic feature of this species. Length and breadth of the figured specimen are 0.47 mm and 0.35 mm respectively.

This species is widely distributed in the Cretaceous of Europe and America. Most of the American Cretaceous records are of Navarro and Taylor ages.

Family GLOBOROTALIIDAE

Genus GLOBOTRUNCANA Cushman, 1927

Globotruncana sp.

Preservation of the present specimens is so ill to precise identification. Diameter of the figured specimen is 0.47 mm.

Family ANOMALINIDAE

Genus PLANULINA d'Orbigny, 1826

Planulina cf. *dumblei* (Applin)

(Plate 1, Figure 21)

Anomalina taylorensis Dumble and Applin, 1924, Pan-Amer. Geol., Vol. 41, p. 342 (nomen nudum).

Truncatulina dumblei Applin, 1925, in Applin, Ellisor and Kniker, Bull. Amer. Assoc. Petrol. Geol., Vol. 9, p. 99, pl. 3, fig. 6.

Anomalina taylorensis Carsey, 1926, Texas Univ. Bull. 2612, p. 47, pl. 6, figs. 1 a, b.

Planulina taylorensis Cushman, 1931, Tennessee Div. Geol. Bull. 41, p. 62, pl. 12, figs. 5 a–c.

Planulina taylorensis Cushman, 1946, U. S. Geol. Surv. Prof. Paper 206, p. 158, pl. 64, figs. 14, 15.

Planulina dumblei Frizzell, 1954, Bureau Econ. Geol., Univ. Texas, Rep. Invest., No. 22, p. 132, pl. 21, fig. 12 a–c.

The single ill preserved specimen is similar to the above-mentioned species in its large and much compressed test, acute periphery and other general features. But the well preserved specimens are indispensable for accurate identification. Diameter of the specimen is 0.90 mm.

Genus CIBICIDES Montfort, 1808

Cibicides cf. *coonensis* (W. Berry)

(Plate 1, Figure 22)

Anomalina coonensis W. Berry, 1929, in Berry and Kelley, U. S. Nat. Mus. Proc., Vol. 76, art. 19, p. 14, pl. 2, figs. 22–24.

Cibicides coonensis Cushman, 1940, Cushman Lab. Foram. Res. Contr., Vol. 16, p. 39, pl. 7, figs. 6–8.

Cibicides subcarinatus Cushman and Deaderick, 1944, Jour. Paleont., Vol. 18, p. 341.

Cibicides subcarinatus Cushman, 1946, U. S. Geol. Surv. Prof. Paper 206, p. 159–160, pl. 65, figs. 8–11.

Cibicides coonensis Frizzell, 1954, Bureau Econ. Geol., Univ. Texas, Rep. Invest., No. 22, p. 133, pl. 21, figs. 18 a–c.

The specimens in the present collection have slightly fewer chambers in the last formed coil than those of the typical forms of this species. Diameter

of the figured specimen is 0.43 mm.

This species is characteristic of the upper Cretaceous of the Gulf Coastal Region of the United States.

Cibicides? sp.

The single fragmentary specimen in the present collection does not warrant description.

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北海道留萌炭田の上部白堊系産有孔虫類

福田　理

摘　要

近年，留萌炭田東部の上部白堊系の正確な分布が当所燃料部石炭課の留萌炭田調査班によつて明らかにされた。この上部白堊系は主として流紋岩質凝灰岩の薄層を挟有する暗灰色の泥岩からなり，2 地点において有孔虫を多産する。30 種類が検出され，そのうち2種は新種である。これらの化石は陸棚浅海下半部あるいは半深海の温暖で，かつ変化の少ない環境を示している。この有孔虫群は合衆国湾岸地方の Navarro あるいは Taylor 層群のものおよび常磐炭田の双葉層群のものに相当し，その層準は欧州標準層序区分の Campanian 階に大体対比されるものと考えられる。

Explanation of Plate I

(All figures X 50)

Figures

1. *Bathysiphon* cf. *alexanderi* Cushman. CF57001
2. *Haplophragmoides glabra* Cushman and Waters. CF57002
3. *Haplophragmoides* cf. *ijimai* Asano. CF57003
4. *Haplophragmoides* sp. 1. CF57004

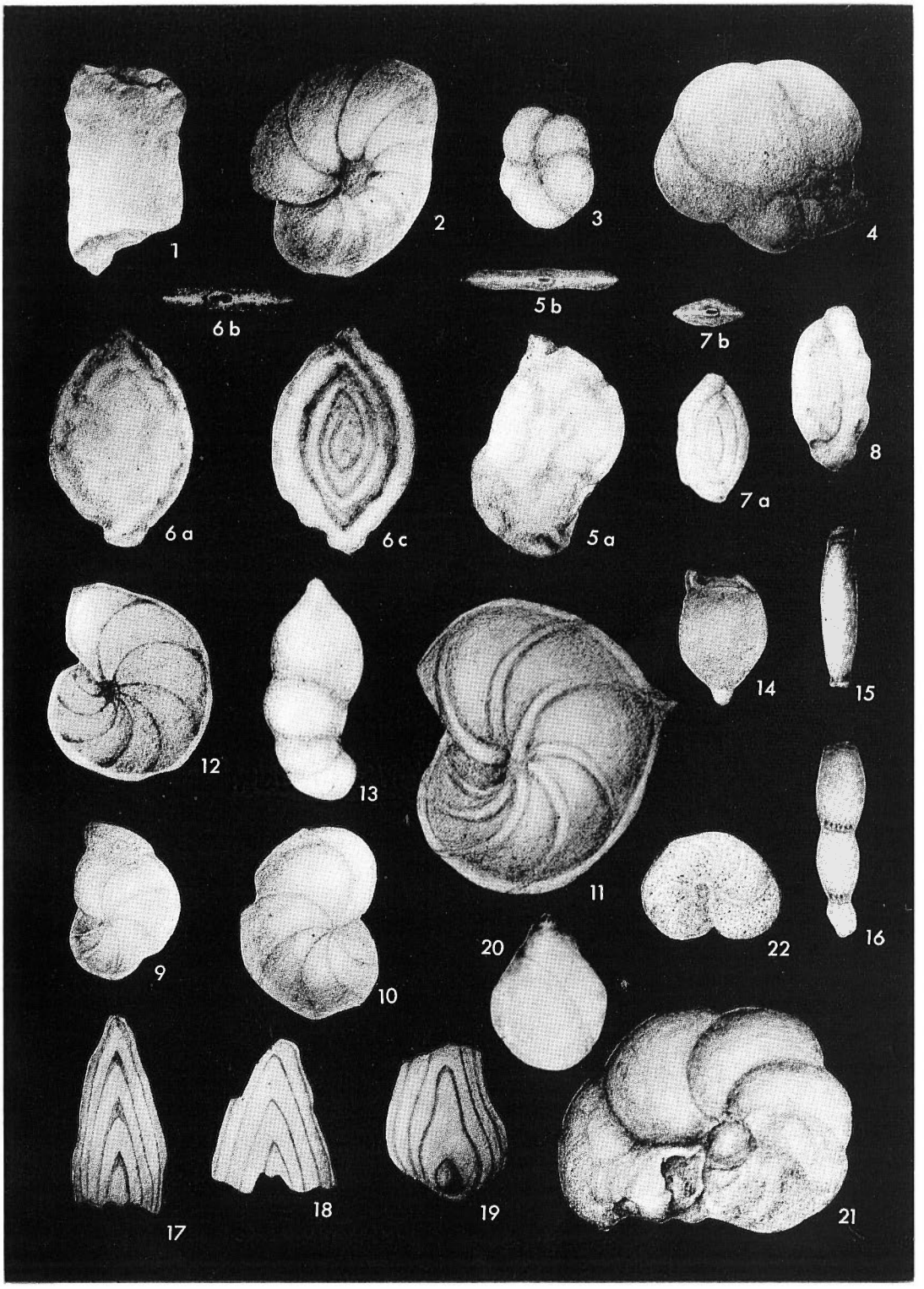
5 a-b. *Rzehakina sogabei* n. sp. CF57005 (Holotype)
a, side view. b, apertural view.

6 a-c. *Rzehakina uryuensis* n. sp. CF57006 (Holotype)
a, side view. b, apertural view.
c, side view, immersed in glycerine.

7 a-b. *Silicosigmoilina futabaensis* Asano. CF57007
a, side view. b, apertural view.

8. *Silicosigmoilina futabaensis* Asano. CF57008
9. *Robulus* cf. *aldrichi* Sandidge. CF57009
10. *Robulus* cf. *discrepans* (Reuss). CF57010
11. *Robulus spisso-costata* Cushman var. CF57011
12. *Lenticulina rotulata* Lamarck. CF57012
13. *Marginulina curvatula* Cushman. CF57013
14. *Dentalina* cf. *catenula* Reuss. CF57014
15. *Dentalina* cf. *consobrina* d'Orbigny. CF57015
16. *Dentalina* cf. *stephensoni* (Cushman). CF57016
17. *Frondicularia* sp. 1. CF57017
18. *Frondicularia* sp. 2. CF57018
19. *Frondicularia* sp. 3. CF57019
20. *Globulina lacrima* Reuss. CF57020
21. *Planulina* cf. *dumblei* (Applin). CF57021
22. *Cibicides* cf. *coonensis* (W. Berry). CF57022

(All figures delineated by F. Kawauchi)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REPORT No. 173

GEOLOGICAL SURVEY OF JAPAN

On the Myophorians from the Miharai-yama Group in Hyōgo Prefecture

By

Nobukazu KAMBE

CONTENTS

On the Myophorians from the Miharai-yama Group in Hyōgo Prefecture

By
Nobukazu KAMBE

Introduction:—On the occasion of the geological survey of Oyaichiba Sheet-Map (1 : 50,000)[8] with O. HIROKAWA and H. TŌGŌ in 1950, the writer was fortunate enough to discover[7] some fossils in the northeastern part. Subsequently he carried out the paleontological study. As the result, the geological age of the fossiliferous Miharai-yama group is assigned to Carno-Noric. Its dating bears importance because it lies discordantly on the intensely disturbed Maizuru zone.

Here the writer tenders his sincere thanks to Prof. T. KOBAYASHI of the Tokyo University for the guidance of this study.

Stratigraphy:—The Miharai-yama group exposed around Miharai-yama in Yabu-gun, Hyōgo prefecture is mainly composed of conglomerate and sandstone beside some intercalations of clayslate and yields fossils at many localities (see. fig. 1). It strikes N 30° W with the dip of 30° NE. With remarkable discordance it overlies the Oya sandstone and clayslate having the ENE strike. This group occurs in the Oya block on the north and the Miharai-yama block on the south by a ENE fault. The Akenobe formation(upper Paleozoic) on the south side contains a lens of fusulinid-limestone. The sequence of the Miharai-yama group in the two blocks is determined as below.

Oya Block	Miharai-yama Block
	Clayslate
	Sandstone and clayslate
	Alternation of sandstone and conglomerate
Sandstone	Clayslate
Alternation of sandstone and conglomerate	Alternation of sandstone and conglomerate
Clayslate and sandstone	
Sandstone and conglomerate containing reworked pebbles of black clayslate, and interbedded with black clayslate	

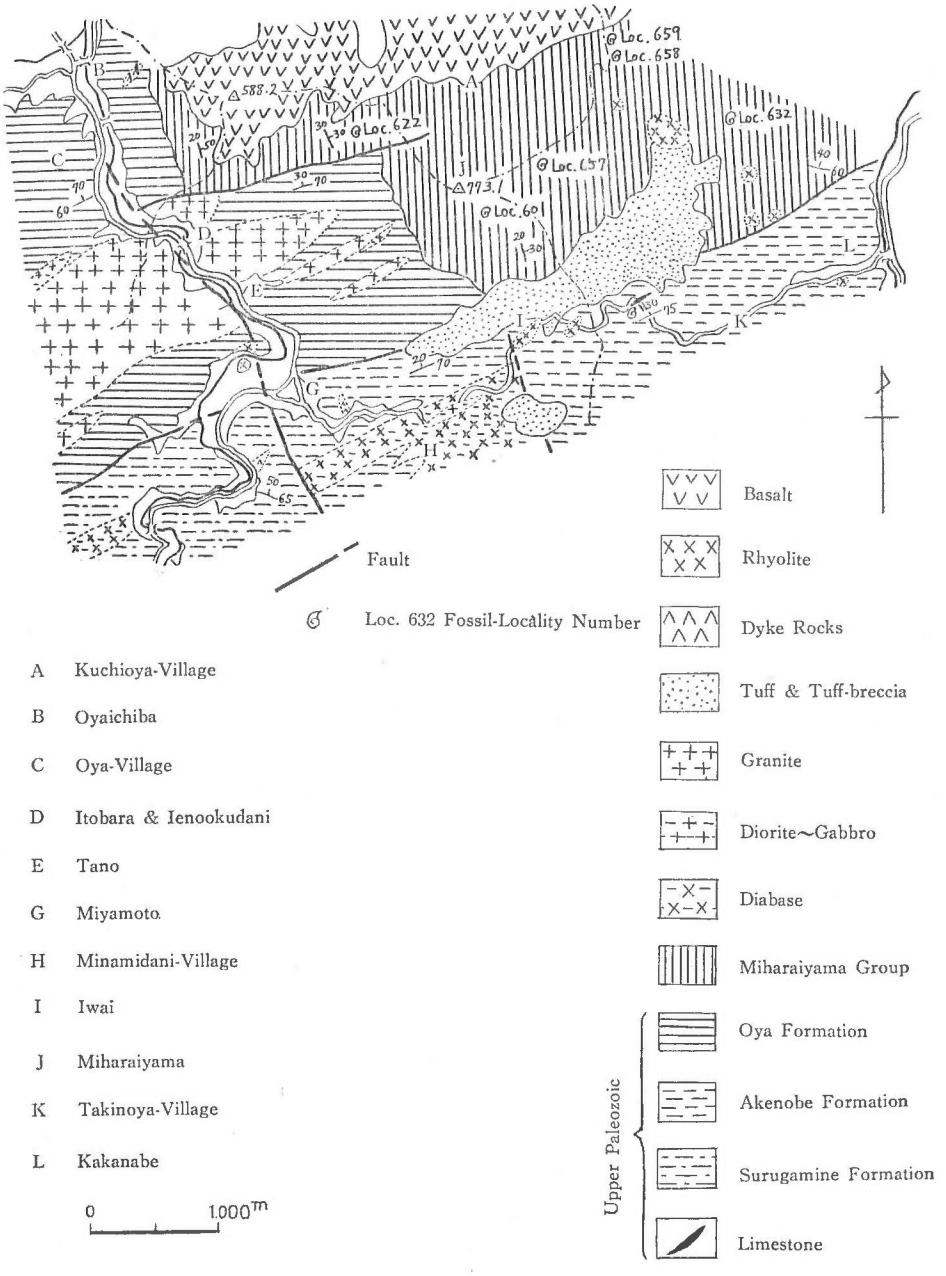

Fig. 1. Geological Map of the Miharai-yama District

Conglomerate, often over 20 m thick, alternates with sandstone. Its pebbles are well rounded. Chert is most abundant and the largest attaining 10 cm in diameter; black clayslate and dioritic rocks are also contained; most pebbles are well rounded.

Subsequent to the writer's discovery of the Triassic fossils, NAKAZAWA and SHIKI (1954)[25] visited this district and classified the Miharai-yama group in descending order as follows;

		thickness
Gannosudani formation	G_3 bluish grey siltstone	200 m
	G_2 bluish grey sandstone	80–95 m
	G_1 conglomerate	50–80 m
Niikuradani formation	N_2 bluish grey sandstone	30–60 m
	N_1 basal conglomerate	15–30 m

unconformity

Minamitani group (Upper Permian)

They asserted the clino-unconformity at the base of the Miharai-yama group and collected *Neobakevellia kambei* MS., *Myophoria* aff. *laevigata* and *Nuculana* sp. from the G_3 bed and *Neobakevellia kambei* MS., *Neobakevellia kambei sakaigawensis* MS., *Myophoria* aff. *laevigata*, *Nuculana* sp. β, *Terebratula* sp. α,? *Terebratula* sp. β, *Rhynchonella* sp.,? *Myalina* sp. etc. from the G_2 bed.

Geological age:—The Miharai-yama fauna is characterized by the preponderance of *Myophoria* and *Gervilleia*, especially of *Myophoria* all of which species belong to E. RÜBENSTRUNK's "*Glatten Myophorien Gruppe*". In the collection from the localities in Fig. 1, nine species and two varieties of *Myophoria* are discriminated as shown in the table 1.

Myophoria tangoensis, *M. shidakensis*, *M.* sp. nov. indet. by KOBAYASHI and ICHIKAWA, 1949, and *M.* cfr. *laevigata* (ZIETHEN) var. *elongata* are the Shidaka elements[15] in the upper Shidaka group[14] the age of which is from upper Carnic to Noric. *M. laevigata* (ZIETHEN) var. *miharaiensis*, new var., and *M.* γ. sp. nov. indet. are also allied to certain Shidaka species, namely the former to *M. laevigata* (ZIETHEN) var. *rotunda* and the latter to *M. shidakensis*. *M. tajimensis*, new species, and *M.* aff. *nakajimensis* are both related closely to *M. nakajimensis* from the middle Carnic *Halobia*-beds of the lower Kochigatani group[13] in the Sakawa basin in Kōchi prefecture. In

Specific Name \ Geological Range and Locality Number	Skytic	Anisic	Ladinic	Carnic	Noric	Rhaetic	622/601	657	659	658	632	662 horizon not determined
Myophoria tajimensis KAMBE, new species.							△△ △	△				
Myophoria laevigata (ZIETHEN).							△				△△	
Myophoria cfr. *laevigata* (ZIETHEN).								△ △	△ △			
Myophoria laevigata (ZIETHEN) var. *miharaiensis* KAMBE, new variety.										△		
Myophoria cfr. *laevigata* (ZIETHEN) var. *miharaiensis* KAMBE.											△	
Myophoria cfr. *laevigata* (ZIETHEN) var. *elongata* PHIL.							△				△△	△
Myophoria cardissoides (ZIETHEN).								△			△	
Myophoria aff. *nakajimensis* ICHIKAWA.							△	△			△	
Myophoria tangoensis KAMBE.											△△	
Myophoria shidakensis KAMBE.								△			△	
Myophoria sp. nov. indet. by KOBAYASHI and ICHIKAWA, 1949.							△					
Myophoria γ. sp. nov. indet.							△					
Myophoria δ. sp. nov. indet.								△			△△	

Table 1. The distribution of the Myophorians in the Miharai-yama group
(△ Mark corresponds to one specimen in the locality)

addition, *M. laevigata, M. cardissoides* and *M.* δ sp. nov. indet. were procured from the group, where the first ranges from upper Skytic to Noric and the second from Anisic to Ladinic.

In short, four Myophorian species are the Shidaka's elements, two allied to the Shidaka's elements, and another two are related to the middle Carnic species of Sakawa. Putting aside *M. laevigata, M. cardissoides* and *M.* δ sp. nov. indet., the Myophorians suggest the geological age from middle Carnic to Noric for the Miharai-yama group.

In the northwestern part of Kyōto prefecture, the lower Carnic Nabae group[21], the Heki formation[16], the middle Triassic Yakuno group[23] and the Kawanishi group[24] play a role in the zonal structure with the Paleozoic formation. These Triassic sediments have the equatorial strike like the Paleozoic sediments. The Shidaka group in the same prefecture is, on the contrary, discordant with the zonal structure and fills a basin on the already disturbed basement. Its age is in the range from upper Carnic to Noric.

In the western Yakuno district, there is the Hirotani formation[9] composed of conglomerate, sandstone and clayslate. It is intruded by granite. It strikes in the NEN direction and dips westerly. In the further west, the Miharai-yama group having the NWN strike and the E dip, covers the Oya formation (upper Paleozoic).

No fossil is as yet discovered from the Hirotani formation, but it is quite similar to those of the Miharai-yama group in rock-facies and geological structure. Therefore, they belong probably to an identical formation which rests on the zonal structure with the clino-unconformity. In other words, the Miharai-yama group is younger than the lower Carnic Nabae group inclusive of the Heki formation, and nearly contemporaneous with the Shidaka group, although K. NAKAZAWA correlated the Miharai-yama group to the Kusano and Kyogakubo formations of the Fukumoto group in Okayama prefecture by the fossils discovered from the G_2 and the G_3 beds and suggested lower Triassic for its geological age.

Incidentally, the Shidaka group yields the following plant fossils [OISHI, (1932・1940)][27][28] near the top which can hardly be as old as Skytic: *Cladophlebis nebbensis* (BRONGN.), *C. denticulata* (BRONGN.), *C. haiburnensis* (L. & H.), *C. Raciborskii* forma *integra* O. & T., Cfr. *Zamites megaphyllus* (PHILLIPS), *Taeniopteris stenophylla* KRYSHT., *T. shitakaensis* OISHI, *Czekanowskia* sp., *Podozamites griesbachi* SEWARD and *P. lanceolatus* (L. & H.).

The Myophcrians from the Miharai-yama and Shidaka groups are all

diminutive. In fact, they are less than 2 cm in length or height, *Myophoria* in Europe is generally much larger. *Myophoria laevigata,* for example, is commonly 6 cm long. It flourished in the *Muschelkalk* of Germany, *Werfener Schichten* of the South Alps etc. The Miharai-yama and Shidaka groups of which conglomerate and sandstone are leading components were deposited in small but profound embayments surrounded by ragged mountains, the environment being presumably so unfavourable for Myophorians that they were atrophied.

Description of Species

1. *Myophoria tajimensis* KAMBE, new species
(Plate 1, Figures 1–4.)

Description:—Shell of medium size, elongated subtrigonal, inequilateral, moderately convex and higher than broad; anterior margin subarcuate and short; ventral arcuate; posterior somewhat arcuate; antero-ventral and postero-ventral margins rounded; umbo located at about anterior two-fifths of shell-length, provided with prominent, straight umbonal ridge in front; posterior submarginal area elongated subtrigonal, forming nearly right angle to main shell along prominent, subarcuate costa. Surface of main shell generally smooth. The angle between umbonal ridge and costa comparatively narrow.

Observation:—One weak radial groove exists on the area of the external mould in the specimen in fig. 2; one narrow but prominent concentric line in the lower part of shell in the holotype specimen; and the small circular impression probably the posterior adductor scar is present in the middle part of the area in the specimens in figs. 1, 2, and 3.

Text-figure 2 shows the hinge of the specimen in fig. 2. The obliquely lined parts indicates projections in the internal mould of the right valve. Accordingly, they correspond to 2b and 2a of the left valve and the sockets to 3b+1 and 1 of the right valve. For the terminology of the dentation, see LEBKÜCHNER[17], 1932, p. 24, fig. 18.

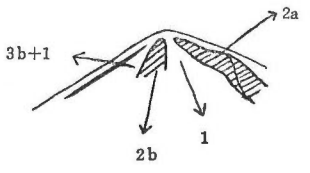

Fig. 2. Sketch showing the hinge of the specimen in pl. I, fig. 2.

Dimension :

Registered Number	F-3148	F-3149	F-3150	F-3151
	right valve	right valve	right valve	left valve
height	19 mm	18 mm	? 19 mm	? 18 mm
length	15 mm	15 mm	15 mm	indet.
apical angle	100°	110°	indet.	110°
apical angle exclusive of the area	80°	90°	indet.	90°

Comparison :—In the elongated costa, this species is closely allied to *Myophoria nakajimensis* ICHIKAWA (1949, p. 180, pl. VI, fig. 4)[13], but the area is rectangular to the main shell in this species, while the angle is very acute in *M. nakajimensis*. The distinguishing feature of this species, from *M. nakajimensis* and the other *laevigata* group of *Myophoria* exclusive of *M.* δ sp. nov. indet., is in its outline higher than broad, as shown in the table.

2. *Myophoria laevigata* (ZIETHEN)
(Plate 1, Figures 5–7.)

1898. aff. *Myophoria laevigata,* BITTNER, *Jahrb. G. R. A., XLVIII,* p. 709, taf. XIV, figs. 22–26.

1908. aff. *Myophoria laevigata,* WITTENBURG, *Zentralbl. f. Min.,* p. 77, text-fig. 10.

1912. cfr. *Myophoria* cf. *laevigata,* MANSUY, *Mém. Serv. Géol. de l'Indochine. Vol. 1, fasc. 4/2,* p. 57, pl. X, fig. 5.

1925. *Myophoria laevigata,* DIENER, Leitfossilien der Trias in *Gürich's Leitfossilien. Lief. IV.* taf. VIII, fig. 8.

1927. *Myophoria laevigata,* O.—GORDON, *Abhandl. der Geol. Bundesanst. Bd. XXIV; Heft 2,* p. 33, taf. III, fig. 2, a. b.

1928. *Myophoria laevigata,* SCHMIDT, Die Lebewelt Unserer Trias, p. 183, fig. 421.

Description :—Shell of small or medium size, subtrigonal or subtrapezoidal, broader than high, inequilateral and somewhat inflated; posterior margin nearly straight and short; ventral subarcuate; anterior nearly straight and very short; antero-ventral rounded; postero-ventral subangular; posterior submarginal area subtrigonal, depressed, bordered anteriorly by a prominent

subangular costa, and divided into two parts by a sharp radial carina near the posterior margin; interspace between costa and carina comparatively wide, deeply excavated; umbo at anterior three-eighths or one-third of shell-length, prominent, moderately projected and provided with prominent and nearly straight umbonal ridge in front; submarginal area and main shell with many, narrow, weak concentric lines. Area and main shell with many concentric lines, one of which near ventral margin is prominent; anterior and posterior margins nearly straight.

Observation:—Text-figures 3 & 4 show the hinges of the specimens in figs. 5 and 7. Projections in the internal moulds of the right valve correspond to 2b and 2a of the left and their sockets to 3b+1 and 1 of the right valve.

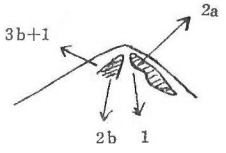

Fig. 3. Sketch showing the hinge of the specimen in pl. I, fig. 5.

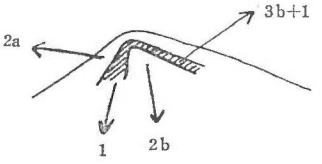

Fig. 4. Sketch showing the hinge of the specimen in pl. I, fig. 7.

Dimension:

Registered Number	F-3152	F-3153	F-3154
	right valve	right valve	left valve
height	5.5 mm	17 mm	15 mm
length	8.0 mm	indet.	21 mm
apical angle	120°	indet.	130°
apical angle exclusive of the area	95°	indet.	105°

Comparison:—This is distinguished from *Myophoria okunominetaniensis* ICHIKAWA (1949, p. 181, pl. VI, figs. 7-9),[13] by its subtrigonal or subtrapezoidal outline, angular costa and angulate postero-ventral margin. That species is roundly trapezoidal, and has a rounded or obtuse angular costa and rounded postero-ventral margin. This is diagnostic of *Myophoria laevigata* (ZIETHEN) in the subtrapezoidal outline and one or two carinae on the submarginal area.

3. *Myophoria* cfr. *laevigata* (ZIETHEN)

(Plate 1, Figures 8–11.)

1925. cfr. *Myophoria laevigata,* DIENER, Leitfossilien der Trias in *Gürich's Leitfossilien, Lief. IV,* taf. VIII, fig. 8.

1927. cfr. *Myophoria laevigata,* O.—GORDON, *Abhandl. der Geol. Bundesanst. Bd. XXIV, Heft 2,* p. 33, taf. III, fig. 2, a. b.

1928. cfr. *Myophoria laevigata,* SCHMIDT, Die Lebewelt Unserer Trias, p. 183, fig. 421.

Description:—Shell small, convex, trigonal, broader than high; posterior margin subarcuate; postero-ventral subangular; ventral arcuate; anterior nearly straight; antero-ventral ill-defined; submarginal area triangular, sometimes with two radial carinae, bordered anteriorly by a blunt costa; umbo sharply twisted towards the plane of commissure between two valves; umbo at about anterior five-thirteenths, prominent and provided with an umbonal ridge in front; surface ornamented by very fine concentric lines.

Observation:—Text-figure 5 shows the hinge.

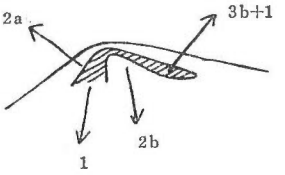

Fig. 5. Sketch showing the hinge of the specimen in pl. I, fig. 8.

Dimension:

Registered Number	F-3155	F-3156	F-3157	F-3158
	left valve	right valve	left valve	left valve
height	? 12 mm	indet.	10 mm	indet.
length	? 13 mm	indet.	indet.	indet.
apical angle	135°	135°	? 135°	indet.
apical angle exclusive of the area	90°	100°	? 100°	100°

Comparison:—The characteristics of this species are the blunt costa, convex shell, and acute costation near the umbo. It is distinguished from *Myophoria okunominetaniensis* ICHIKAWA (1949, p. 181, pl. VI, figs. 7–9)[13] by its trigonal form and broad apical angle. The latter is rounded and has a narrow apical angle. Cfr. *Myophoria laevigata* (ZIETHEN) var. *rotunda* PHIL.

by KAMBE (1951, p. 53, pl. 4, figs. 6a-b)[15] has a more rounded outline and a shorter costa. The outline of the shell and the aspect of the submarginal area are closely allied to *Myophoria laevigata* (ZIETHEN).

4. *Myophoria laevigata* (ZIETHEN) var. *miharaiensis* KAMBE, new variety
(Plate 1, Figure 12.)

Description:—Shell small, broadly ovate, longer than high, inequilateral and somewhat inflated; posterior, ventral and anterior margins arcuate; postero-ventral and antero-ventral ones rounded; posterior submarginal area subtrigonal, bordered anteriorly by a prominent subangulate costa, more remarkably so near umbo than on the other side, narrow near umbo, broad near postero-ventral margin, curved in the middle part; umbo at seven-sixteenths from the posterior end, prominent and provided with a prominent and straight umbonal ridge in front; submarginal area and main part smooth; dentation not clearly observed.

Dimension:

Registered Number	F-3159
	right valve
height	11 mm
length	16 mm
apical angle	140°
apical angle exclusive of the area	110°

Comparison:—The posterior position of the umbo, subangulate costa curved in the middle, ovate shell-outline, and entire margin are the characteristics of this species. It is allied to cfr. *Myophoria laevigata* (ZIETHEN) var. *rotunda* PHIL. by KAMBE (1951, p. 53, pl. 4, figs. 6a-b.)[15], in outline and costation, but is distinguished in the position of the umbo, namely, the umbo is anterior in cfr. *M. laevigata*.

5. *Myophoria* cfr. *laevigata* (ZIETHEN) var. *miharaiensis* KAMBE
(Plate 1, Figure 13.)

Description:—Shell of medium size, subtrigonal, broader than high, nearly equilateral and moderately inflated; posterior margin arcuate; posteroventral subangular; ventral arcuate; anterior nearly straight, almost rectangular to

ventral margin; posterior submarginal area with two weak radial carinae, elongated semi-oval and bordered anteriorly by a prominent subangulate costa, especially angulated near umbo, curved in the middle; umbo lying at about posterior eight-seventeenths of shell-length, prominent and provided with arcuate umbonal ridge in front; submarginal area and main shell with a concentric narrow line in the lower part; dentation not well known.

Dimension:

Registered Number	F-3160
	right valve
height	15 mm
length	17 mm
apical angle	130°
apical angle exclusive of the area	100°

Comparison:—This specimen is closely allied to *Myophoria laevigata* (ZIETHEN) var. *miharaiensis* KAMBE, but the antero-ventral margin of this is broken off.

6. *Myophoria* cfr. *laevigata* (ZIETHEN) var. *elongata* PHIL.
(Plate 1, Figures 14–17.)

1928. cfr. *Myophoria laevigata* var. *elongata,* SCHMIDT, Die Lebewelt Unserer Trias, p. 185, fig. 425.

1951. cfr. *Myophoria laevigata* (ZIETHEN) var. *elongata,* KAMBE, *Trans. Proc. Palaeont. Soc. Japan, N. S., No. 2,* p. 53, pl. 4, figs. 5a–b.

Description:—Shell small, elongated subtrigonal, broader than high, very inequilateral and moderately inflated; posterior margin arcuate; postero-ventral subangular; ventral seemingly subarcuate; anterior arcuate, very short, about half as long as posterior margin; posterior submarginal area large, elongate, semi-oval and bordered anteriorly by a prominent angular or subangular costa, more remarkably so near umbo than near postero-ventral margin; umbo lying at about a third from anterior end, prominent and provided with a subarcuate umbonal ridge in front; area divided into two parts by a prominent radial groove extending from umbo to posterior margin; surface smooth.

Observation:—Text-figure 6 shows the hinge of the specimen in fig. 15.

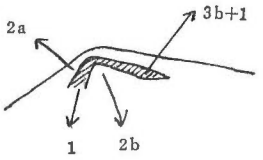

Fig. 6. Sketch showing the hinge of the specimen in pl. I, fig. 15.

Dimension :

Registered Number	F-3161	F-3162	F-3163	F-3164
	left valve	left valve	right valve	left valve
height	5 mm	8 mm	9 mm	10 mm
length	8 mm	14 mm	15 mm	14.5 mm
apical angle	130°	150°	130°	140°
apical angle exclusive of the area	110°	120°	110°	120°

Comparison :—This is closely allied to cfr. *Myophoria laevigata* var. *elongata* PHIL. by KAMBE[15], 1951, from the Shidaka group, of which the geological age is upper Carnic or Noric. The elongate outline of the shell exclusive of the submarginal area, its inflation and subangular costa and the angle between the subangular costa and the anterior margin. But the posterior margin is roundly arcuate in the former and long and arcuate in the latter. The subangular costa is prominent in the former and weak in the latter.

7. *Myophoria cardissoides* (ZIETHEN)
(Plate 1, Figures 18–19.)

1928. *Myophoria cardissoides,* SCHMIDT, Die Lebewelt Unserer Trias, p. 185, fig. 427.

Description :—Shell small, subtrigonal, very inequilateral, moderately flat, and nearly as broad as high; anterior margin subarcuate; ventral arcuate; posterior nearly straight; posterior-ventral margins forming an acute angle; antero-ventral rounded; umbo located at about five-twelfths from anterior end, provided with prominent, straight umbonal ridge in front; posterior submarginal area rectangular to main shell at prominent, straight costa; surface smooth.

Observation :—Text-figures 7 & 8 show the hinges of the specimens in

figs. 18 and 19.

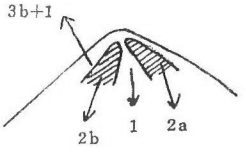

Fig. 7. Sketch showing the hinge of the specimen in pl. I, fig. 18.

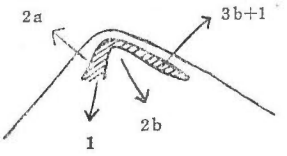

Fig. 8. Sketch showing the hinge of the specimen in pl. I, fig. 19.

Dimension :

Registered Number	F-3165	F-3166
	right valve	left valve
height	11 mm	indet.
length	12 mm	12 mm
apical angle	105°	indet.
apical angle exclusive of the area	95°	indet.

Comparison :—This form is allied to *Myophoria cardissoides* (ZIETHEN) in the right angle between the posterior area and the main shell and in the posterior depression of main shell near the costa. But these are distinguished from *Myophoria nakajimensis* ICHIKAWA (1949, p. 180, pl. VI, fig. 4)[13] by the costation, namely straight in the former and arcuate in the latter. The umbo is not so anterior in the former as in the latter.

8. *Myophoria* aff. *nakajimensis* ICHIKAWA
(Plate 1, Figures 20–22.)

1949. aff. *Myophoria nakajimensis* ICHIKAWA, *Jap. Jour. Geol. Geogr.*, Vol. 21, Nos. 1–4, p. 180, pl. VI, fig. 4.

Description :—Shell of medium or small size, elongated subtrigonal, very inequilateral, nearly flat, and nearly as broad as high; anterior margin nearly straight; ventral arcuate; posterior straight; postero-ventral angle acute; antero-ventral rounded; umbo located at about a third from anterior end, provided with prominent, straight umbonal ridge in front; posterior submarginal area forming a very acute angle with main shell along straight costa; surface smooth; dentation not well known.

Dimension :

Registered Number	F-3167	F-3168	F-3169
	left valve	left valve	right valve
height	6 mm	19 mm	12 mm
length	6 mm	indet.	indet.
apical angle	90°	indet.	indet.
apical angle exclusive of the area	90°	indet.	indet.

Comparison :—This form is allied to *Myophoria cardissoides* (ZIETHEN) in shell-form, but the angle between the posterior area and the main shell is very acute in the former, but 90 degrees in the latter. It is allied to *Myophoria nakajimensis* ICHIKAWA in shell-form, but the costa is nearly straight in the former and more or less arcuate in the latter.

9. *Myophoria tangoensis* KAMBE
(Plate 1, Figures 23-24.)

1951. *Myophoria tangoensis* KAMBE, *Trans. Proc. Palaeont. Soc. Japan, N. S., No. 2*, p. 51, pl. 4, figs. 1a-b.

Description :—Shell of small, or medium size, subtrapezoidal broader than high, especially convex; posterior area semicircular, broad and bordered anteriorly by a prominent angular costa, especially notable in fig. 24, costa acute near the umbo but blunt near the postero-ventral margin; posterior and anterior margins nearly arcuate, short; ventral margin arcuate; antero-ventral rounded; umbo lying at about anterior three-eighths, pointed forward, prominent and provided with a broad, prominent, nearly straight umbonal ridge in front; surface smooth. See text-figures 9 & 10 for dentition.

Observation :—Area comparatively depressed, with a radial carina in fig. 23, adductor scar observed in fig. 24.

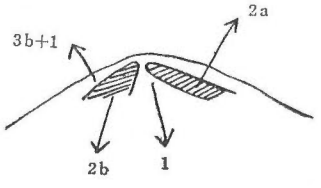

Fig. 9. Sketch showing the hinge of the specimen in pl. I, fig. 23.

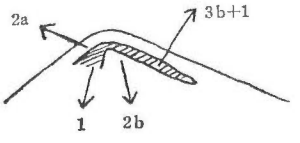

Fig. 10. Sketch showing the hinge of the specimen in pl. I, fig. 24.

Dimension:

Registered Number	F-3170	F-3171
	right valve	left valve
height	8 mm	12 mm
length	12 mm	17 mm
apical angle	160°	160°
apical angle exclusive of the area	110°	120°

Comparison:—These specimens are identified with *Myophoria tangoensis* KAMBE, because of the similarity in the outline, the broadly expanded area, the broad prominent umbonal ridge almost reaching to the ventral margin and the broad apical angle.

10. *Myophoria shidakensis* KAMBE
(Plate 1, Figures 25-26.)

1951. *Myophoria shidakensis* KAMBE, *Trans. Proc. Palaeont. Soc. Japan, N. S., No. 2*, p. 51, pl. 4, figs. 2a-b.

Description:—Shell small or medium in size, elongated subtrigonal, as high as broad or broader than high, moderately convex; posterior margin nearly straight, postero-ventral margin probably subangular; ventral moderately arcuate; antero-ventral rounded, anterior short and nearly straight; posterior area triangular and bordered anteriorly by a prominent subangulate costa, straight extending as far as postero-ventral margin; umbo lying at about a third from anterior end, prominent and provided with a nearly straight umbonal ridge in front; area with posterior adductor scar at mid-height; surface smooth; concentric lines of growth observable; dentation not well known.

Dimension:

Registered Number	F-3172	F-3173
	left valve	right valve
height	18 mm	12 mm
length	18 mm	13 mm
apical angle	110°	110°
apical angle exclusive of the area	90°	90°

Comparison :—These specimens are identifiable with *Myophoria shidakensis* KAMBE with reference to the coincidence of the costation, the situation of the umbo and the shell convexity. In fig. 26, the costation is straight and more or less subangular. In the lower part of the shell, two concentric elevations are distinct in fig. 25 but obscure in fig. 26.

11. *Myophoria* sp. nov. indet. by KOBAYASHI and ICHIKAWA, 1949
(Plate 1, Figure 27.)

1949. *Myophoria* sp. nov. indet. KOBAYASHI & ICHIKAWA, *Jap. Jour. Geol. Geogr.*, Vol. 21, Nos. 1–4, p. 183, pl. VI, fig. 5.

1951. *Myophoria* β sp. nov. indet., by KOBAYASHI and ICHIKAWA, 1949, KAMBE, *Trans. Proc. Palaeont. Soc. Japan, N. S., No. 2*, p. 52, pl. 4, figs. 4a–b.

This represented by only one small poorly preserved specimen "(1) 601E" whose postero-ventral and ventral margins are broken out. This is allied to *Myophoria* sp. nov. indet. KOBAYASHI & ICHIKAWA in a round costa and roundly convex shell, umbo forwardly pointed, and a prominent umbonal ridge. Dentation not well known; and ornamentation absent.

12. *Myophoria* γ, sp. nov. indet.
(Plate 1, Figure 28.)

Description :—Shell of medium size, moderately convex, elongated trigonal; anterior margin arcuate; antero-ventral rounded; ventral arcuate; postero-ventral subangular; posterior nearly straight; submarginal area subtriangular, with two prominent carinae; adductor scar circular and bordered anteriorly by a prominent angular costa. Umbonal ridge arcuate, stringed to main shell; in the internal mould, umbo located at about five-twenty-seconds from anterior end, opisogyre, pointed backward, provided arcuate, prominent umbonal ridge in front, but in external mould is umbo nearly orthogyre;

Dimension :

Registered Number	F-3175
	right valve
height	16 mm
length	22 mm
apical angle	130°
apical angle exclusive of the area	110°

surface with many fine growth lines, two ventral ones of which are prominent; subarcuate costa with convexity on antero-ventral side; dentation not well known.

Comparison :—This species is different from all other Miharai-yama species by the opisthogyre umbo and arcuate costation in the internal mould. In the elongated trigonal form this is somewhat allied to *Myophoria shidakensis* KAMBE.

13. *Myophoria* δ, sp. nov. indet.
(Plate 1, Figures 29–31.)

Description :—Shell small, nearly equilateral, somewhat inflated and higher than broad; anterior margin nearly straight; ventral arcuate; posterior arcuate; antero ventral and postero-ventral margins rounded; umbo located at about mid-length, gently turning toward the plane of junction between two valves, provided with short subarcuate or nearly straight umbonalridge; posterior area crescent, forming obtuse angles to main shell along prominent, subarcuate costa; area divided into two parts by a narrow radial groove; surface smooth; angle between umbonal ridge and costa comparatively narrow; the specimen in fig. 31. deformed; dentation not well known.

Dimension :

Registered Number	F-3176	F-3177	F-3178
	right valve	right valve	left valve
height	indet.	11 mm	13 mm
length	12 mm	10 mm	11 mm
apical angle	105°	105°	90°
apical angle exclusive of the area	90°	90°	70°

Comparison :—These specimens are allied to the specimen in fig. 18. of *Myophoria cardissoides* (ZIETHEN), but different from the latter in the position of umbo, costation, posterior angulation and the ratio of height to length. In the ratio, it is close to *Myophoria tajimensis* KAMBE, but they disagree in the posterior angulation and apical angle.

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要　旨

兵庫縣の御祓山層群産 *Myophoria* について

神　戸　信　和

廣川治・東郷文雄両技官とともに1950年に 5 万分の 1 大屋市場図幅を調査した際に，はからずも養父郡南谷村御祓山を中心として礫岩・砂岩・粘板岩からなり，走向 N 30°W，傾斜 30°NE を示して，上部古生層の大屋層の上に傾斜不整合に重なるとみなされる御祓山層群が分布し，これに動物化石群を産することが判明した。その後，動物化石群につき，とくに *Myophoria* について研究した結果を報告する。

御祓山層群から産する *Myophoria* のなかに，下記のように，1 新種，8 種（うち 1 種は近似種），1 新変種，1 変種（近似種）ほかに 2 近似種を認めることができた。

Myophoria tazimensis KAMBE, new species
Myophoria laevigata (ZIETHEN)
Myophoria cfr. *laevigata* (ZIETHEN)
Myophoria laevigata (ZIETHEN) var. *miharaiensis* KAMBE, new variety
Myophoria cfr. *laevigata* (ZIETHEN) var. *elongata* PHIL.
Myophoria cardissoides (ZIETHEN)
Myophoria aff. *nakajimensis* ICHIKAWA
Myophoria tangoensis KAMBE
Myophoria shidakensis KAMBE
Myophoria sp. nov. indet. by KOBAYASHI and ICHIKAWA, 1949
Myophoria γ. sp. nov. indet.
Myophoria δ. sp. nov. indet.

これらの *Myophoria* は御祓山層群の各層準から知られ，産出岩相は主として砂岩である。また，"*Gervilleia*" と最も多く共存して産する。すべて，E. Rübenstrunk の "*Glatten Myophorien Gruppe*" に属するものである。

M. tangoensis, M. shidakensis, M. sp. nov. indet. by KOBAYASHI and ICHIKAWA, 1949 および *M.* cfr. *laevigata* (ZIETHEN) var. *elongata* は upper Carnic から Noric の志高層群上部の動物化石群の要素で，*M. laevigata* (ZIETHEN) var. *miharaiensis,* new var. および *M.* γ. sp. nov. indet. は志高層群からのある種に近似し，すなわち，前者は *M. laevigata* (ZIETHEN) var. *rotunda* に，後者は *M. shidakensis* に近似している。*M. tajimensis,* new species および *M.* aff. *nakajimensis* は両者とも高知縣佐川盆地の下部河内ヶ谷層群の middle Carnic の *Halobia*-beds から産出する *M. nakajimensis* に近似している。さらに，*M. laevigata, M. cardissoides* および *M.* δ. sp. nov. indet. は，前者は upper Skytic から

Noric に，後者は Anisic から Ladinic にわたるものである。

京都府北西部に分布する三畳系のうち，lower Carnic の難波江層群，日置層，中部三畳系の夜久野層群および河西層群は古生層と帯状構造を形成するのに反し，志高層群は，帯状構造と一致しない。本文に記述した御祓山層群も帯状構造の上に傾斜不整合に横たわるものである。

以上のように，*Myophoria* の地質時代および地質構造の観點から，御祓山層群は lower Carnic の難波江層群より若く，middle Carnic から Noric にわたるものであることを指摘し，志高層群とほゞ同時代であると結論する。

Explanation of Plate I

All of these specimens are discovered from the Miharai-yama group in Yabu-gun, Hyōgo prefecture, Japan, and are kept in the Geological Survey of Japan. Locality Number is seen in the geological map. (see text-figure 1.)

Myophoria tajimensis KAMBE, new species.

Fig. 1. Internal mould of the holotype; right valve, (Reg. No. F-3148) x 1. (Loc. No. 601)

Fig. 2. Internal mould of a paratype; right valve, (Reg. No. F-3149) x 1. (Loc. No. 622)

Fig. 3. Internal mould of a paratype; right valve, (Reg. No. F-3150) x 1. (Loc. No. 622)

Fig. 4. Internal mould of a paratype; left valve, (Reg. No. F-3151) x 1. (Loc. No. 657)

Myophoria laevigata (ZIETHEN)

Fig. 5. Internal mould of the right valve, (Reg. No. F-3152) x 1. (Loc. No. 601)

Fig. 6. Internal mould of the right valve, (Reg. No. F-3153) x 1. (Loc. No. 632)

Fig. 7. Internal mould of the left valve, (Reg. No. F-3154) x 1. (Loc. No. 632)

Myophoria cfr. *laevigata* (ZIETHEN)

Fig. 8. Internal mould of the left valve, (Reg. No. F-3155) x 1. (Loc. No. 657)

Fig. 9. Internal mould of the right valve, (Reg. No. F-3156) x 1. (Loc. No. 657)

Fig. 10. Internal mould of the left valve, (Reg. No. F-3157) x 1. (Loc, No. 659)

Fig. 11. Internal mould of the left valve, (Reg. No. F-3158) x 1. (Loc. No. 659)

Myophoria laevigata (ZIETHEN) var. *miharaiensis* KAMBE, new variety

Fig. 12. Internal mould of the holotype; right valve, (Reg. No. F-3159) x 1. (Loc. No. 658)

Myophoria cfr. *laevigata* (ZIETHEN) var. *miharaiensis* KAMBE

Fig. 13. Internal mould of the right valve, (Reg. No. F-3160) x 1. (Loc. No. 632)

Myophoria cfr. *laevigata* (ZIETHEN) var. *elongata* PHIL.

Fig. 14. Internal mould of the left valve, (Reg. No. F-3161) x 1. (Loc. No. 601)

Fig. 15. Internal mould of the left valve, (Reg. No. F-3162) x 1. (Loc. No. 632)

Fig. 16. Internal mould of the right valve, (Reg. No. F-3163) x 1. (Loc. No. 632)

Fig. 17. Internal mould of the left valve, (Reg. No. F-3164) x 1. (Loc. No. 662)

Myophoria cardissoides (ZIETHEN)

Fig. 18. Internal mould of the right valve, (Reg. No. F-3165) x 1. (Loc. No. 632)

Fig. 19. Internal mould of the left valve, (Reg. No. F-3166) x 1. (Loc. No. 657)

Myophoria aff. *nakajimensis* ICHIKAWA

Fig. 20. Internal mould of the left valve, (Reg. No. F-3167) x 1. (Loc. No. 601)

Fig. 21. Internal mould of the left valve, (Reg. No. F-3168) x 1. (Loc. No. 632)

Fig. 22. Internal mould of the right valve, (Reg. No. F-3169) x 1. (Loc. No. 657)

Myophoria tangoensis KAMBE

Fig. 23. Internal mould of the right valve, (Reg. No. F-3170) x 1. (Loc. No. 632)

Fig. 24. Internal mould of the left valve, (Reg. No. F-3171) x 1. (Loc. No. 632)

Myophoria shidakensis KAMBE

Fig. 25. Internal mould of the left valve, (Reg. No. F-3172) x 1. (Loc. No. 632)

Fig. 26. Internal mould of the left valve, (Reg. No. F-3173) x 1. (Loc. No. 657)

Myophoria sp. nov. indet. by KOBAYASHI and ICHIKAWA, 1949

Fig. 27. Internal mould of the right valve, (Reg. No. F-3174) x 1. (Loc. No. 601)

Myophoria γ sp. nov. indet.

Fig. 28. Internal mould of the right valve, (Reg. No. F-3175) x 1. (Loc. No. 601)

Myophoria δ sp. nov. indet.

Fig. 29. Internal mould of the right valve, (Reg. No. F-3176) x 1. (Loc. No. 632)

Fig. 30. Internal mould of the right valve, (Reg. No. F-3177) x 1. (Loc. No. 632)

Fig. 31. Internal mould of the left valve, (Reg. No. F-3178) x 1. (Loc. No. 657)

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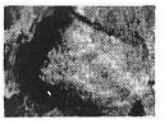

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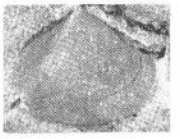

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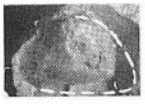

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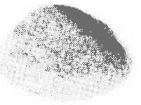

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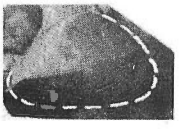

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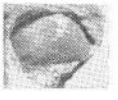

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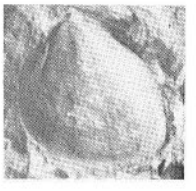

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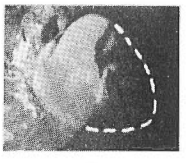

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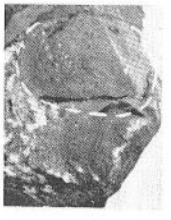

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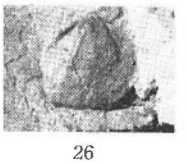

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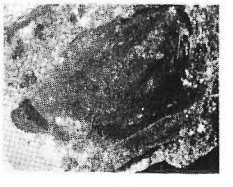

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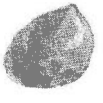

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(Photo by Y. Masai)

The Geological Survey of Japan has published in the past several kinds of reports such as the Memoirs, the Bulletin, and the Report of the Geological Survey.

Hereafter, all reports will be published exclusively in the Reports of the Geological Survey of Japan. The Report will be consecutive to the numbers of the Report of the Imperial Geological Survey of Japan hitherto published. As a general rule, each issue of the Report will have one number, and for convenience's sake, the following classification according to the field of interest will be indicated on each Report.

A. Geology & allied sciences
- a. Geology
- b. Petrology and Mineralogy
- c. Paleontology
- d. Volcanology and Hotspring
- e. Geophysics
- f. Geochemistry

B. Applied geology
- a. Ore deposits
- b. Coal
- c. Petroleum and Natural gas
- d. Underground water
- e. Agricultural geology
  Engineering geology
- f. Physical prospecting,
  Chemical prospecting & Boring

C. Miscellaneous

D. Annual Report of Progress

Note: In addition to the regularly printed Reports, the Geological Survey is newly going to circulate "Bulletin of the Geological Survey of Japan", which will be published monthly commencing in July 1950.

本所刊行の報文類の種目には従來地質要報・地質調査所報告等があつたが，今後はすべて刊行する報文は地質調査所報告に改めることとし，その番號は従來の地質調査所報告を追つて附けることにする。そして報告は1報文につき報告1册を原則とし，その分類の便宜のために次の如くアルファベットによる略號を附けることにする。

A. 地質およびその基礎科學に関するもの
- a. 地　質
- b. 岩石・鉱物
- c. 古生物
- d. 火山・温泉
- e. 地球物理
- f. 地球化學

B. 應用地質に関するもの
- a. 鉱　床
- b. 石　炭
- c. 石油・天然ガス
- d. 地下水
- e. 農林地質・土木地質
- f. 物理探鉱・化學探鉱および試錐

C. そ の 他

D. 事業報告

なお刊行する報文以外に，當分の間報文を謄寫して配布したものに地下資源調査所速報があつたが，今後は地質調査所月報として第1号より刊行する。

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