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Fossil on the cover is the six leaves in a whorl of *Trizygia oblongifolia* (GERM. & KAULF.) ASAMA from the Maiya Formation (*Parafusulina* zone), Maiya, N.E. Japan.

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666. ON *PALAEOFUSULINA-COLANIELLA* FAUNA FROM THE UPPER PERMIAN OF KELANTAN, MALAYSIA

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マレーシア北部，ケランタン地方のレビール河の支流，パローおよびレライ河地域から，最上部ペルム系をしめす *Palaeofusulina* aff. *bella-Colaniella media* fauna を発見した。この有孔虫化石群は *Palaeofusulina* と *Colaniella* による上部ペルム系の2化石帯のうち，advanced form で特徴づけられる上位の *Palaeofusulina sinensis-Colaniella parva* 帯に対比される。東南アジア地域においてこの化石帯が発見された意義は，テチス海地域の対比に関してはもちろん，上位に下部三畳系の *Claraia concnetrica* bed も発達することから，ペルムートリアス系問題に関連する重要な基礎資料である。この有孔虫化石群の構成種17種を図示し，そのうち定方位薄片の得られた *Palaeofusulina* aff. *bella*, *P.* sp., *Colaniella media*, *C. parva*, *Neoendothyra* sp., *Nodosaria* cf. *radicula*, and *Abadehella* cf. *coniformis* の7種を記載した。 P. C. Aw・石井健一・沖村雄二

Ulu Kelantan, southern part of Kotabaru is the folded region of the Late Paleozoic and Triassic strata. Numerous foraminiferal specimens of the Late Palaeozoic (from *Fusulinella* zone to *Palaeofusulina-Colaniella* zone), including fusulinids are discovered in the Sungei Lebir (Lebir River) of this region. However biostratigraphical studies have not been completed.

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Palaeofusulina and *Colaniella* association is discovered at several localities along Sungei Paloh and S. Relai, branches of S. Lebir. And the Lower Triassic beds including *Claraia concentrica* overlie seemingly conformably the Upper Permian beds that bear *Palaeofusulina* and *Colaniella*. By the first discovery of *Palaeofusulina* and *Colaniella* fauna, the presence of the Upper-most Permian was confirmed in Malaysia.

In 1913 *Palaeofusulina prisca* had been discovered at first by DEPRAT from Lang Nac of Tonkin (North Viet-Nam) and in 1924 *Colaniella parva* had been discovered by COLANI from Khon Loc of Tonkin.

Recently the reexamination of microfossils of the Upper Permian is becoming important for international correlation, furthermore in the course of palaeontological studies on the Permian-Triassic boundary problems the biostratigraphical significance of the smaller Foraminifera is becoming clear. Fusulinid Foraminifera occur from the late early Carboniferous to the Permian and during this period they distribute worldwide in the Upper Carboniferous and Lower and Middle Permian. In the Upper Permian their prosperity draws to a close and in the end of Permian they become extinct. In spite of the fact that the Upper Permian is a period of decline for fusulinids, in the Tethys region some fusulinids, that is to say, *Palaeofusulina-Reichelina* fauna develops. *Palaeofusulina-Reichelina* fauna is often accompanied with numerous smaller Foraminifera, among which *Colaniella* is a typical index fossil of the Upper Permian.

In 1975 ISHII, OKIMURA and NAKAZAWA made clear a biostratigraphical significance of *Palaeofusulina-Colaniella* fauna in the Upper Permian. According to their opinion, *Palaeofusulina-Colaniella* fauna is divided into two characteristic faunas of species order. That is to say, the lower part of the Upper Permian is characterized by *Palaeofusulina simplex-Colaniella minima* fauna, and the upper part is characterized by *Palaeofusulina sinensis-Colaniella parva* fauna.

Malaysian fauna is composed of *Palaeofusulina* aff. *bella*, *Colaniella media* and and others. The above species of *Palaeofusulina* and *Colaniella* are often accompanied with *P. sinensis* and *C. parva* in China and Japan. Accordingly, Malaysian *Palaeofusulina-Colaniella* fauna is comparable to that of the Mikata Formation of the Maizuru group in Japan and the Changhsing Limestone of the Lopingian in South China, which represents the latest Permian.

We wish to express our most sincere gratitude to Geological Survey of Malaysia and to Director General Mr. YIN EE HENG for giving us facility of our studies. We are also obliged to Prof. K. NAKAZAWA of Kyoto University for his help and encouragement.

Geological setting

The type locality (FSKN-19) occurs in stream called Sungei Paloh in South Kelantan (see locality map). The fossils were found in argillo-tuffaceous limestone which is interbedded with pyroclastic rocks and minor argillaceous sediments. The bedding trace generally strikes NNW-SSE with dip to the WSW. The rocks are folded, but owing to lack of continuous outcrops, local variation in bedding trace and minor folds, the true structure and stratigraphy of the area are difficult to decipher.

Together with the type locality there seems to be 8 layers varying from 5 to 25 meters thick of argillo-tuffaceous limestone occurring at various parts of the pyroclastic sequence. Some other foraminifers have been found in some of the similar looking outcrops (FSKN-17, 18 & 20). Preliminary search in the other outcrops revealed some organic remains in the thin sections.

The argillo-tuffaceous limestone is a very distinctive rock containing various amounts of argillaceous matter and volcanic fragments. Locally it may grade into argillite or tuff. The volcanic fragments are of various sizes ranging from

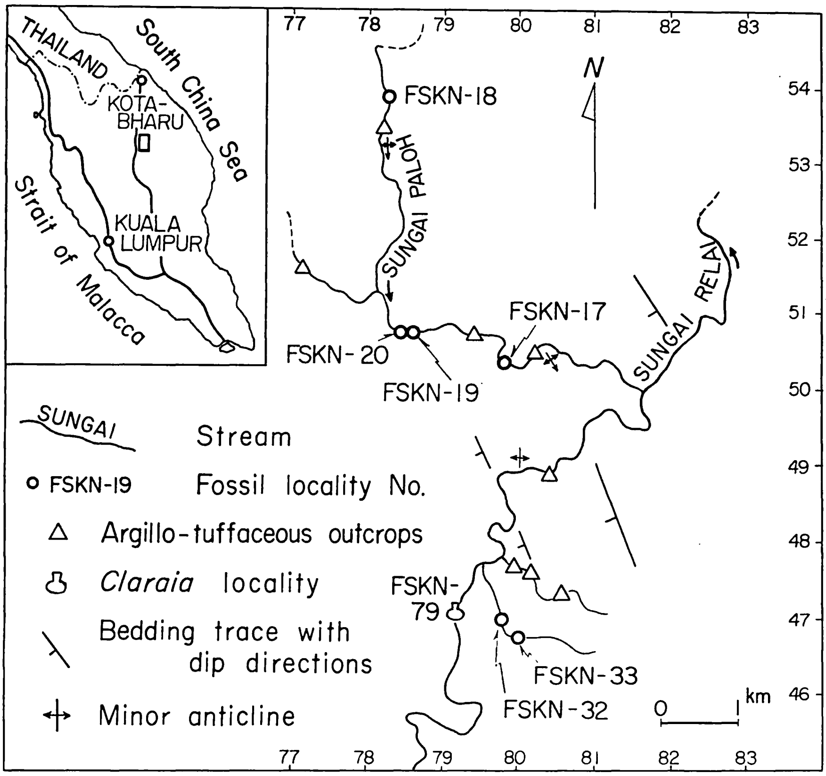


Fig. 1. Map showing the sampling localities in the Sungei Paloh and S. Relai areas, Kelantan, Malaysia.

less than 1 cm. to more than 10 cm in diameter. On eroded surfaces the volcanic fragments, being more resistant, are well seen, but the calcareous parts are eroded into irregular cavities (Fig. 2). It is this vuggy appearance which gives the rock its distinctive character.

Overlying the pyroclastic sequence conformably is a layer about 40 meters thick of marble interbedded and laminated with slate. In one part of the slate (FSKN-79) some pelecypods were found. Mr. E. H. YIN tentatively identified one important genus, *Claraia* sp. which TAMURA (written communication) later confirmed to be *Claraia griesbachi concentrica* YABE of Lower to Middle Skytic age.

Systematic description

The description of foraminifers is made by ISHII and OKIMURA. The described specimens are kept at Geological Survey of Malaysia H. Q.

Phyllum Protozoa

Class Rhizopoda

Order Foraminiferida

Family Fusulinidae

Subfamily Schubertellinae

Genus *Palaeofusulina* DEPRAT, 1912

Palaeofusulina sp. aff. *P. bella* SHENG

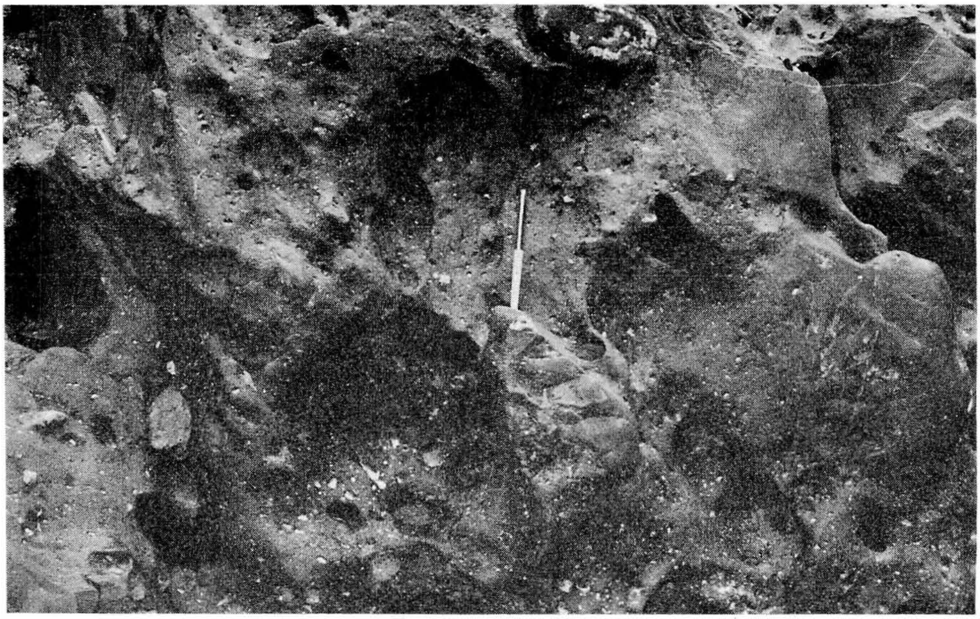


Fig. 2. Photograph shows the typical eroded surface of the argillo-tuffaceous limestone. Note the cavities and tuff fragments. Scale: ball pen 14 cm. (Photo by P. C. Aw)

Pl. 43, fig. 1

Compare—

1963. *Palaeofusulina bella* SHENG, *Palaeont. Sinica*, N. S. B, no. 10, pp. 54, 55, 179, 180, pl. 10, figs. 25-27.

Materials—An axial, a sagittal and a tangential sections were examined, but samples are not so good. FSKN 32, 33-1 and 33-2.

Description—Test small thickly fusiform with straight axis of coiling and with bluntly pointed poles. Lateral slopes slightly convex. Number of volution 3 1/2.

Mature tests, 1.63-1.85 mm long and 1.04-1.19 mm width; with form ratio 1.3+-1.8. Test coil loosely, coiling expands uniformly outward. Proloculus of typical specimen spherical in shape, 0.18 mm. in outside diameter. Spirotheca thin, composed of a tectum and diaphanotheca, measuring 11 microns in thickness in 2 1/2 volution. Chomata not observed; in outer volutions they seem to be substituted by pseudochomata which are wall of chamberlets at outside tunnel. Tunnel well defined. Septa fluted throughout length of chamber, and chamberlets often contact with the floor of the next chamber.

Specimen	L.	W.	R.	P.	Vol. no.
FSKN 33-1	1.85	1.04	1.8	0.18	3 1/2
FSKN 33-2	1.63?	1.19	1.3+	0.11	3 1/2
FSKN 32	—	1.06+	—	0.12	3 1/2

RV (mm)				Ratio of Hl/RV			
1	2	3	3 1/2	1	2	3	3 1/2
0.12	0.26	0.44	0.58	1.6	1.6	1.6	1.7
0.12	0.29	0.50	0.68	1.6	1.9	1.5	—
0.12	0.27	0.42	0.62	—	—	—	—

HV (mm)				pl., fig.	
1	2	3	3 1/2		
0.06	0.14	0.17	0.23	43	1
0.08	0.17	0.23	0.23	—	—
0.08	0.14	0.15	0.26	—	—

L. length, W. width, R. ratio, P. proloculus, Vol. no. number of volution, RV. radius vector, Hl. half length, HV. height of volution

Remarks—The present specimens resemble *Palaeofusulina bella* SHENG from the Changhsing Limestone exposed near Zhongliangshan of Chungking, Szechuan Province in South China, in the test form, size, form ratio at maturity, and other shell characters. However, the writers do not identify the present specimens with *Palaeofusulina bella* by a reason that the Malaysian specimens are not sufficient in the individual number.

The present specimens are comparable with *Palaeofusulina sinensis* from the same locality in South China, but the former differs from the latter in small size, relatively broader septal fluting and fewer number of volutions.

Horizon—*Palaeofusulina bella* SHENG occurs in *Palaeofusulina-Reichelina* fauna which is represented by *Palaeofusulina sinensis*, *P. prisca*, *Reichelina cribroseptata*, *R. changhsingensis*, etc. from the *Palaeofusulina* zone, Lopingian, South China.

Palaeofusulina sp.

Pl. 43, fig. 2

Only one axial section in poorly preservation with a minute proloculus measuring about 0.06 mm. in outer diameter. Test small thickly fusiform with straight axis of coiling and with bluntly pointed poles. Lateral slope slightly convex. Number of volution 3. Coiling expands rapidly in the last volution. The heights of the first to the third volution are 0.05, 0.09 and 0.03 mm. (last 2 1/2), respectively.

Spirotheca thin, composed of a tectum and diaphanotheca. Chomata seem to be substituted by pseudochomata which are wall of chamberlets at outside tunnel. Tunnel well defined. Septa fluted throughout length of chamber.

Remarks—The present specimen resemble *Palaeofusulina simplicata* SHENG from the Changhsing Limestone near Zisongzheng of Wangmo, Kueichow Province of South China in shell form, the feature of septal fluting and other shell characters. Since. this form is represented by only one axial section which is brokened in outer shell, it is better to leave this specimen unnamed until more sufficient material becomes available.

Specimen	L.	W.	R.	P.	Vol. no.	pl.	fig.
FSKN 20	?	?	?	0.06	3	43	2

RV (mm)			Ratio of Hl RV			HV (mm)		
1	2	3	1	2	3	1	2	3
0.09	0.18	0.55	1.0	1.3	1.1	0.05	0.09	0.30

Family Colaniellidae

Genus *Colaniella* LIKHAREV, 1939

Colaniella media M-MAKLAY

Pl. 43, figs. 5, 6 and 9

1954. *Colaniella media* M-MAKLAY, *State Sci. Tech. Publ. Geol. Literat.*, p. 55, pl. 7, figs. 1-8, pl. 8, fig. 1.
1966. *Colaniella media*, WANG, *Act. Paleont. Sinica*, vol. 14, no. 2, p. 214 (in Chinese), pl. 3, figs. 6-14.
1975. *Colaniella parva*, TAZAWA, *Jour. Geol. Soc. Japan*, vol. 81, no. 10, pl. 1, figs. 7 and 8.

Materials—All the examined specimens belonging to this species are partly broken out and incomplete; there are an obliquely longitudinal (from the loc. FSKN 20), a transverse (from the loc. FSKN 19) and some oblique sections which may be referable to this species. Their partition-character of the third order could not be clearly defined because of the poor preservation.

Description—Test relatively large in size, conoidal, tapered toward a proloculus, consisted of strongly overlapped 13 chambers or more. Chambers broadly flattened in central part, and steeply inclined in the lateral parts. Such squarish bowl-shaped chambers uniserially and rectilinearly arranged, increasing gradually in size except for ones of the later stage slightly and gently decreased. Additional angle of chambers about 45 degrees more or less in the early stage. Wall calcareous, thick in comparison with shell-size, consists of two layers; outer layer thick and vitreous, and inner layer very thin, probably microgranular. Interior of chambers subdivided into 15 or more chamberlets by longitudinal plain partitions of the first order. The small partitions of the second order commonly developed, but the third partitions in order may be only observed in the last stage. Aperture single, opening at terminal end of the last chamber, having probably radial incisions formed by projections of the first longitudinal partitions in order.

Dimensions—Although the true length could not measured owing to the absence of the complete specimen, the length of this species from the Kelantan may be reached 1.0 mm. or more, judging from the maximum length of the figured oblique section (pl. 43, fig. 5). The maximum width 0.61 mm. in the figured transverse section (pl. 43, fig. 6).

Remarks—The species more resembles *Colaniella parva* (COLANI) in shell form than any other species of *Colaniella*, but the former is distinguished from the latter with the broadly flattened central part, and steep inclination of the lateral part of chambers, and strongly tapered shell of the younger stage.

Horizon—It is well known that *Colaniella media* M-MAKLAY is an index fossil of the upper Dzhulfian age. M-MAKLAY (1954) defined first this species from the Nikitin and Urshten formations, Dzhulfian of the Northern Caucasus. In South China, this species is an important faunal element of the upper Upper Permian (WANG, 1966).

Colaniella parva (COLANI)

Pl. 43, fig. 7
and

Colaniella sp. cf. *C. parva* (COLANI)

Pl. 43, fig. 8

1924. *Pyramis parva* COLANI, *Indochine, Geol. Surv. Mem.*, vol. 11, fasc. 1-2, p. 181, pl. 29, figs. 2, 4-14, 15a-f, 16-17, 19, 21 and 24.
1939. *Colaniella parva*, LIKHAREV, An atlas of

the leading forms of fossil fauna of the USSR; vol. 6, Permian, *Leningrad Cent. Geol. Prospect. Inst.*, p. 25-31, pl. 1, figs. 10-13.

1946. *Pyramis parva*, REICHEL, *Eclogae Geol. Helv.*, vol. 38, no. 2, p. 542, 544, 547, pl. 19, figs. 13, 14, p. 543, tf. 32a-h, p. 545, tf. 33, p. 546, tf. 34.
1954. *Colaniella parva*, M-MAKLAY, *Trud. Vses. Nauch-Issled. Geol. Inst* (VSEGEI), p. 52-54, pl. 4, figs. 1-12.
1966. *Colaniella parva*, WANG, *Acta Paleont. Sinica*, vol. 14, no. 2, p. 214, (in Chinese), pl. 4, figs. 13-18.
1975. *Colaniella parva*, OKIMURA, ISHII and NAKAZAWA, *Mem. Fac. Sci. Kyoto Univ., Ser. Geol. Mineral.*, vol. XLI, no. 2, p. 29-30, pl. 1, figs. 9-12.
1975. *Colaniella parva*, TAZAWA, *Jour. Geol. Soc. Japan*, vol. 81, no. 10, p. 632-633, pl. 1, figs. 5-6, 9-11.
1965. *Colaniella parva*, ISHII, OKIMURA and NAKAZAWA, *Jour. Geosci. Osaka City Univ.*, vol. 19, art. 6, pl. 1, figs. 1-3, pl. 4, fig. 4.

Materials—A transverse and a few oblique sections were examined, and a nearly longitudinal section is comparable to this species. The specimens are mainly occurred from the loc. FSKN 20.

Description—Test large, subovoid, tapered weakly toward a proloculus. 12 or more chambers of dome-shape strongly overlapped, uniserially and rectilinearly arranged; increasing gradually from the early to middle stages and decreasing gently in the later stage in size. Lateral part of chambers draws an arc-line. 14 longitudinal plain partitions of the first order radially arranged, and 28 small chamberlets divided into compartments by the thin partitions of the second order. The third small partitions in order developed on the chamber floor of the last stage. Wall calcareous, composed of thick vitreous outer layer, and indistinctive, thin, dense inner layer. Aperture single, round funnel-like with radial incisions, opening on the terminal part of the last chamber.

Dimensions—The maximum width 0.64 mm. in the figured specimen (pl. 43, fig. 7). The maximum length 1.24 mm. and the maximum width 0.68 mm in the nearly longitudinal section of the comparable specimen figured in pl. 43, fig. 8.

Remarks—The species is closely allied to *Colaniella media* M-MAKLAY in the form, structure and size of the shell. However, the latter are characterized with the broadly flattened floor in its central part of the chambers, and also differs from the former in its steep inclination of the lateral part of chambers.

TAZAWA's specimens were described as *C. parva* (pl. 1, figs. 7 and 8, 1975) from the Upper Permian of the Kitakami Massif, may be referred to *Colaniella media* M-MAKLAY by their steep inclination of the lateral part and broadly flattened central part of chambers.

Horizon—The occurrences of *Colaniella parva* (COLANI) are worldwidely limited to the formations which are correlated to the Upper Dzhulfian age (the Dorashamian) of the Tethysian Sea as follows; Greece, Northern Caucasus, Indochine, South China, Japan and South Sichote-Alin. ISHII, OKIMURA and NAKAZAWA (1975) discussed on these localities and the foraminiferal faunas, and estimated this species is the zonal index fossil of the Upper Dzhulfian.

Family Tetrataxidae

Genus *Abadehella* OKIMURA and ISHII, 1975

Abadehella sp. cf. *A. coniformis* OKIMURA and ISHII

Pl. 43, fig. 18

Compare—

1975. *Abadehella coniformis* OKIMURA and ISHII, *Mem. Fac. Sci. Kyoto Univ., Ser. Geol. Mineral.*, vol. XLI, no. 1, p. 43, pl. 2, figs. 1-5, 7 and 8, pl. 1, fig. 3, pl. 4, figs. 2-4.
1975. *Abadehella coniformis*, ISHII, OKIMURA and NAKAZAWA, *Jour. Geosci. Osaka City Univ.*, vol. 19, art. 6, pl. 3, fig. 9, pl. 4, fig. 13.

Descriptive remarks—Although an oblique section is only examined, from the loc. FSKN 20, with respect to the development of septal partitions, the conical shell-form and size of basal part, and the chamber arrangement, these characters of this specimen are comparable to those of many specimens from the lower part of the Abadeh formation, the Upper Permian of the Central Iran. Lateral slope is slightly concave on one side, and slightly uneven in the later stage. Wall is calcareous, consisting of two layers; thin, dark microgranular outer layer, and thick, vitreous inner layer. Small chamberlets of 12 or more in number are compartmented by septal partitions which are similar to the structure of the outer wall.

Horizon—The occurrences of *Abadehella coniformis* OKIMURA and ISHII are limited to the Upper Permian as follows; The Abadeh formation of the Central Iran, the Zewan formation of the Kashmir of Northern India, the Takauchi and Kashiwadani limestones of the Maizuru group of Southwest Japan, and the Iwaizaki limestone of the Kanokura formation of Northeast Japan.

Family Endothyriidae

Genus *Neoendothyra* REITLINGER, 1965

Neoendothyra sp.

Pl. 43, fig. 14

Compare—

1965. *Neoendothyra* sp. No. 2, REITLINGER, *Otdel. Nauk Zemle, Geol. Inst., Bop. Mikropaleont.*, No. 9, p. 61, (diagnosis of the genus *Neoendothyra*), pl. 1, figs. 4 and 5.
1975. *Neoendothyra* sp., ISHII, OKIMURA and NAKAZAWA, *Jour. Geosci. Osaka City Univ.*, vol. 19, art. 6, pl. 2, fig. 13.

Material—An axial section in regard to the later volution was only examined, from the loc. FSKN 20.

Description—Test small, involute, lenticular form tapered in the marginal part; consists of two volutions, but the coiling axes of the early and the later parts obliquely joined. Umbilical part roundly convexed on one side, but on the other side slightly plain. A few small chambers in the first volution observed, but its number obscured and unknown due to the notable development of the secondary deposits in the axial part and on the floor of the second whorl. The characters of septa and aperture also unknown owing to the absence of the sagittal section in regard to the later volution. Wall calcareous, thin, consists of a heterogeneous microgranular calcite.

Dimensions—The maximum length 0.40 mm. and the maximum width 0.21 mm. in the figured specimen (pl. 43, fig. 14). Form ratio about 0.52.

Remarks—This specimen is closely similar to REITLINGER's specimen of *Neoendothyra* sp. No. 2 (1965, pl. 1, fig. 5) with respect to the inflated lenticular shell-form and the remarkable development of secondary deposits such as axial filling similar to those in some fusulinid, and the rotated axis between the early and later stages. But in shell-size the former is smaller than the latter, in which the maximum length and width were measured 0.53 mm. and 0.35 mm. respectively in REITLINGER's figure.

This species differs from *Neoendothyra reicheli* REITLINGER in its inflated lenticular shell-form, and is also distinguished from *N. parva* (LANGE) in its notable development of the secondary deposits.

Horizon—It is noteworthy that the type species of *Neoendothyra reicheli*, was described from the lower triassic of the "Induan" of Dzhulfa area, Transcaucasus, USSR, although *Neoendothyra* sp. No. 2, of REITLINGER (1965) was reported form the Gnishkskii horizon, the upper Middle Permian of the Baisal Mountain, Transcaucasus, USSR. The referable specimen is figured by ISHII et al. (1975) as a faunal element of the *Lepidolina kumaensis* zone from the Haigyu formation of the Shikoku, Southwest Japan.

Family Nodosariidae

Genus *Nodosaria* LAMARCK, 1812

Nodosaria sp. cf. *N. radicula* (LINNE)

Pl. 43, fig. 16

Compare—

1854. *Nodosaria geinitzi*, REUSS, *Jahresbericht Wetterauer Gesel.*, vol. for 1851-1853, p. 77, fig. 12.
1876. *Nodosaria radicula* (LINNE), BRADY *Paleontgr. Soc.* Publ. 30, p. 124-127, pl. 10, figs. 6-16.
1959. *Nodosaria geinitzi*, KASHRICHEV, *Yaktsuk Fil. Sibil. Otdel. Akad. Nauk USSR.*, p. 16, pl. 1, fig. 3.
1965. *Nodosaria* ex gr. *geinitzi*, REITLINGER, *Otdel. Nauk Zeml. Geol. Inst. Mikropaleont.* No. 9, pl. 2, fig. 11.
1970. *Nodosaria geinitzi*, ZAWADOVSKY et al., *Minist. Geol. RSGSR.*, *Mazadanesk Knik. Izdat.*, p. 31, pl. 85, figs. 8-9.

Material—A longitudinal section of the adult part was only examined, from the loc. FSKN 20. Although the specimen is incomplete one, the species is identified by its subglobose chambers of regular size.

Description—Test small, cylindrical form with distinct sutures perpendicular to longitudinal axis. Three subglobose chambers of the adult stage uniserially and rectilinearly arranged. Chambers of the early stage brocken out, but ones of regular size in adult stage the most important character to identify this species. Wall calcareous, transparent, composed of indistinct fibrous calcite, and thickened in apertural part. Aperture single, relatively large composed with shell-size, funnel-like, opens at terminal part of shell.

Dimensions—In the figured specimen (pl. 43, fig. 16), the maximum length 0.53 mm. and the maximum width 0.19 mm. Chamber-height 0.09 mm. to 0.11 mm. The complete specimen have a shell of 0.9 mm. more or less in length and 0.25 mm. more or less in width in the Russian specimens compared above, therefore the early part of this examined specimen must be broken out.

Comparison—*Nodosaria radicula* (LINNE) is easily distinguished from any other species of *Nodosaria* in its subglobular chambers of almost analogous size throughout the growth stage, or very slightly tapered shell, but this specimen is designated a sa comparable species because of an incomplete one.

Horizon—The age of all the specimens described from the Permian Zechstein of Germany can not be known in detail, but according to BRADY (1876) this species is commonly distributed in the Kupferschiefer of Germany and Middle Zechstein, and in England it is confined to the upper Magnesian Limestone Series. The Russian specimens are reported from the Omolonskaya horizon (Ufimskii), lower Upper Permian, and from the "Induan" (Dorashamian) of the Transcaucasus.

On the faunal characters of Foraminifera from the Upper Permian sediments in the Kelantan

The identified foraminifers from the Sungei Paloh and S. Rerai area, Kelantan and their localities (Fig. 1) are listed as follows (the numbers in round brackets show the figured ones of the plate):

Locality FSKN 19; agglomerate with biolithite-pebbles *Palaeofusulina* sp., *Reichelina* sp., *Colaniella media* M-MAKLAY, *C.* sp., *Glomospira* sp., *Lunucammina* sp., and *Pachyphloia* sp.

Locality FSKN 20; argillo-tuffaceous limestone. *Chusenella*? sp., *Palaeofusulina* aff. *bella* SHENG, *P.* sp. (2), *Reichelina* sp. (4), *Staffella* sp., *Abadehella* cf. *coniformis* OKIMURA and ISHII (18), *Agathammina* sp. (15), *Cribrogenerina* sp., *Colaniella media* M-MAKLAY (5, 9), *C. parva* (COLANI) (7), *C.* cf. *parva* (COLANI) (8), *C.* sp., *Globivalvulina* sp. (19), *Glomospira* sp., *Lunucammina* sp. (12), *Nodosaria* cf. *radicula* (LINNE) (16), *Nodosinella* ? sp., *Neoendothyra* sp. (14), *Pachyphloia* sp., *Tuberitina* sp. and Palaeotextulariids.

Locality FSKN 32; tuffaceous calcirudite. *Palaeofusulina* aff. *bella* SHENG, *P.* sp., *Reichelina* sp. (3), *Colaniella* sp. (10), *Cribrogenerina* sp. (11), *Glomospira* sp., *Lunucammina* sp., *Nodosaria*? sp., *Pachyphloia* sp., *Palaeotextularia* sp., *Paraglobivalvulina* ? sp. and *Tetrataxis* sp. (17).

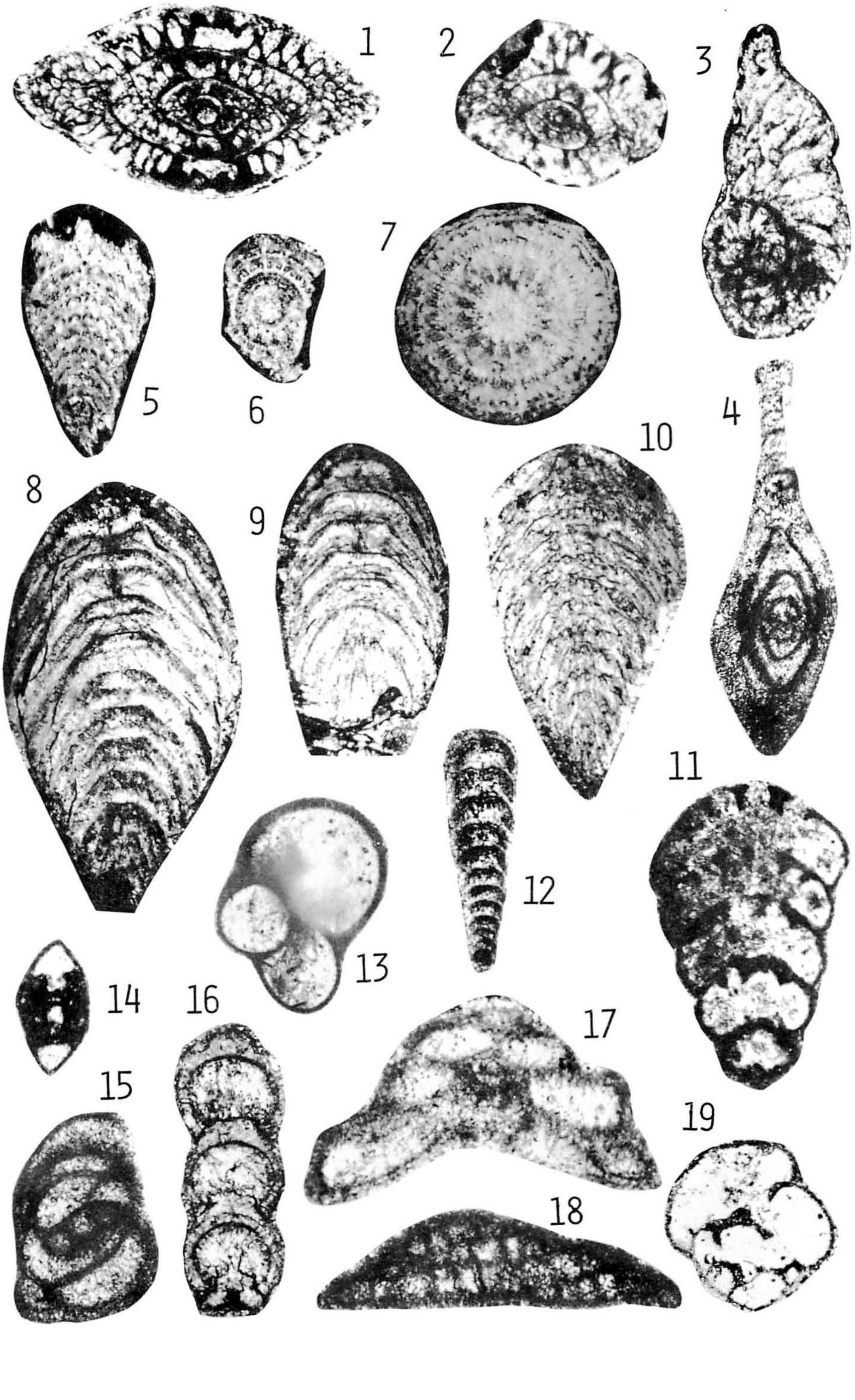
Locality FSKN 33; taffaceous calcirudite. *Palaeofusulina*a ff. *bella* SHENG (1), *Reichelina* ? sp., *Agathammina* sp. and *Colaniella* sp.

The foraminiferal fauna of this area consists mainly of the foraminifers of long range from the Middle to the upper Upper Permian, as REITLINGER (1954, fig. 2) showed synthetically and phylogenetically on the Upper Permian foraminifers from the Transcaucasus, USSR, and as ISHII et al. (1975, table 1 and pl. 4) showed with a faunal list of the Upper Permian of Japn.

However, *Palaeofusulina* and *Colaniella* in this area are very important index fossils of the upper Upper Permian as above mentioned description. According-

Explanation of Plate 43

Fig. 1. *Palaeofusulina* aff. *bella* SHENG. Axial section, loc. FSKN 33, ×30.
Fig. 2. *Palaeofusulina* ap. Axial section, loc. FSKN 20, ×50.
Fig. 3. *Codonofusiella* sp. Sagittal section, loc. FSKN 32, ×50.
Fig. 4. *Reichelina* sp. Axial section, loc. FSKN 20, ×80.
Figs. 5, 6 and 9. *Colaniella media* M-MAKLAY. 5; oblique section, loc. FSKN 20, ×36. 6; transverse section, loc. FSKN 19, ×36. 9; obliquely longitudinal section, loc. FSKN 32, ×50.
Fig. 7. *Colaniella parva* (COLANI). Transverse section, loc. FSKN 20, ×50.
Fig. 8. *Colaniella* cf. *parva* (COLANI). Longitudinal section, loc. FSKN 20, ×50.
Fig. 10. *Colaniella* sp. Oblique section, loc. FSKN 32, ×50.
Fig. 11. *Cribrogenerina* sp. Oblique section. loc. FSKN 32, ×50.
Fig. 12. *Lunucammina* sp. Normal longitudinal section, loc. FSKN 20, ×50.
Fig. 13. *Tuberitina* sp. Cross section, loc. FSKN 20, ×80.
Fig. 14. *Neoendothyra* sp. Axial section, loc. FSKN 20, ×50.
Fig. 15. *Agathammina* sp. Cross section, loc. FSKN 20, ×80.
Fig. 16. *Nodosaria* cf. *radicula* (LINNE). Longitudinal section, loc. FSKN 20, ×80.
Fig. 17. *Tetrataxis* sp. Longitudinal section, loc. FSKN 32, ×80.
Fig. 18. *Abadehella* cf. *coniformis* OKIMURA and ISHII. Oblique section, loc. FSKN 20, ×80.
Fig. 19. *Globivalvulina* sp. Oblique section, loc. FSKN 20, ×50.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ly, the foraminiferal fauna including the advanced forms of *Palaeofusulina* and *Colaniella* in this area is unquestionably referable to the *Palaeofusulina sinensis-Colaniella parva* fauna of the upper Upper Permian estimated by ISHII, OKIMURA and NAKAZAWA (1975).

Hereafter, it goes without saying that the Permian-Triassic formations of this area should be biostratigraphically studied, and based on the more detailed field observation and more samples.

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Trans. Proc. Palaeont. Soc. Japan, N.S., No. 104, pp. 418-423, pl. 44, Jan. 20, 1977

667. A BRIEF NOTE ON *ANCYLOCERAS* FROM THE HAIDATEYAMA FORMATION, KYUSHU*

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九州佩楯山層より産出した *Ancyloceras* について：東九州の秩父帯にサンドウィッチ構造を示して断片的に露出する下部白亜系の地層は佩楯山層と呼ばれ，産出する化石群より宮古統上部階に属するであろうとされてきた。最近になってその下部層よりバレミアン〜アプチアンの境界部を特徴づける国際的にも極めて有効な示準化石である *Ancyloceras* が発見された。このことから同層の時代，特にその下部層は少なくともアプチアン階の下部，ないしはさらにバレミアン階の最上部（宮古統下部階の下部ないしはさらに有田統の最上部）にまでさかのぼり得ることが明らかになった。本論では化石の記載に加えて同層の時代について再検討を試みる。

野田雅之

Introduction

The Lower Cretaceous Haidateyama Formation outcrops in the area of Mt. Haidateyama and its northern foot, eastern Kyushu. The area belongs to the Chichibu Terrain of the Outer Zone of Southwest Japan.

The stratigraphy and the geological structure of the area were previously reported by FUJII (1954) and TERAOKA (1970). FUJII correlated this formation to the Albian Yatsushiro Formation of western Kyushu, by means of faunal assemblage. Further, TERAOKA pointed out that the Haidateyama Formation may include somewhat younger sediments than the Yatsushiro Formation on the stratigraphic evidence (see TERAOKA 1970, p. 12).

In 1972, I unexpectedly obtained a specimen of ammonite from the lower part of this formation. In this paper I describe the specimen and reexamine the geological age of the Haidateyama Formation.

Before going further, I express my sincere thanks to Professor Tatsuro MATSUMOTO of Kyushu University for his kind guidance and critical reading the typescript.

Geological setting

The Haidateyama Formation mainly outcrops in the Haidateyama area. It is commonly demarcated by faults and in part unconformably oversteps the Paleozoic strata. The same formation is also exposed in another tectonic zone in the north which extends from Osaka to Higashidani. The outcrops are shown in Text-fig. 1.

1. Haidateyama area. The Haidateyama Formation in the type Haidateyama area (Text-fig. 1, A; Text-fig. 2, A) can be divided into the following three members by minor sedimentary cycles.

(1). Basal member (HK 1). About 300 m in thickness, mainly massive conglo-

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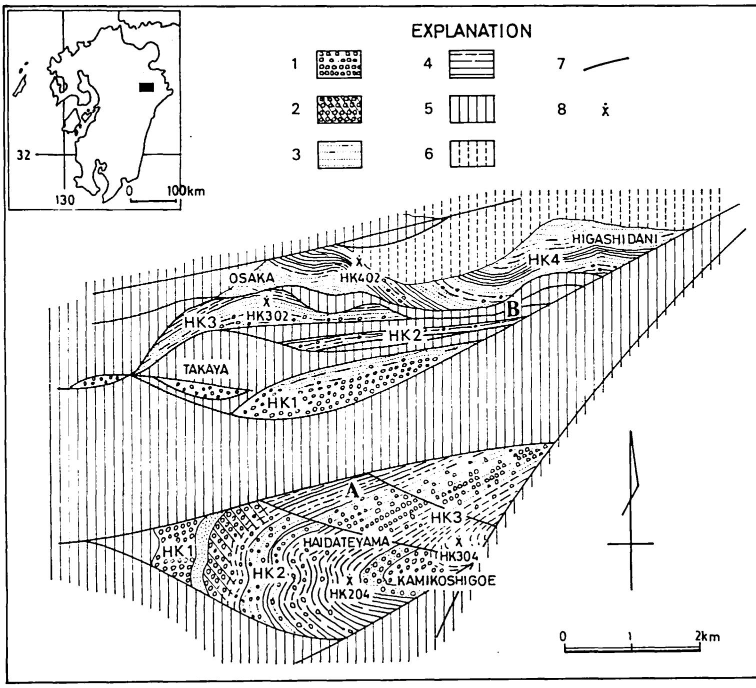


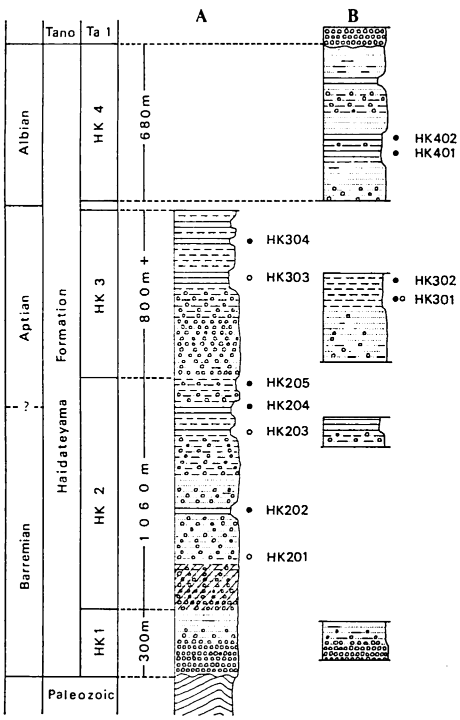
Text-fig. 1. Geological map of the Haidateyama area. A: Haidateyama area, B: Osaka and Higashidani areas, 1: conglomerate, 2: red conglomerate, 3: sandstone, 4: mudstone, 5: older complex, 6: Upper Cretaceous (Tano Formation), 7: fault, 8: fossil locality (after TERAOKA, 1970).

meratic deposits with interbeds of sandy siltstone. Lower part: ill-sorted angular or subangular boulders and cobbles. Upper part: well-sorted conglomerate with well rounded pebbles and greenish or reddish matrix and becoming gradually finer upward.

(2). Lower member (HK 2). About 1060 m in thickness. Lower part: thick-bedded conglomerate with intercalations of dark gray or green siltstone. Conglomerate mainly composed of ill-sorted chert breccias with siliceous materix. Upper part: alternation of siltstone and sandstone with frequent interbeds of conglomerate and with more predominant mudstone upward. Plant fossils contained at two horizons and molluscan fossils at three horizons. The described fossil was obtained at Loc. HK204 of this member.

(3). Upper member (HK 3). Thickness at least 800 m but the upper limit is unknown because of the synclinal structure. Granule conglomerate, dark gray sandy mudstone and fine-grained sandstone. The sandy mudstone includes two fossiliferous beds, of which lower one contains plant fossils and the upper one neritic bivalves.

2. Osaka and Higashidani areas. The Haidateyama Formation in another zone (Text-fig. 1, B; Text-fig. 2, B) extending from Osaka to Higashidani outcrops in four narrow belts separated by faults. The three in the Osaka area are demarcated respectively by strike faults with



Text-fig. 2. Stratigraphic columnar section of the Haidateyama Formation. solid circle: animal fossil, empty circle: plant fossil (adapted from TERAOKA, 1970).

ENE-WSW trend, showing sandwich structure between the Paleozoic strata, and the other in the Higashidani area is unconformably overstepped by the Upper Cretaceous Tano Formation. The sequence is incomplete in these belts.

(1). Southern belt of Osaka area (HK 1). Mainly conglomeratic deposits about 150 m in thickness, with partial interbeds of sandy siltstone or fine-grained sandstone. The conglomerate is referable to that of the basal member in the type Haidateyama area.

(2). Northern belt of Osaka area. The sequence probably represents the upper horizon than that of southern belt and is separated by fault in two outcrops, of which the southern one probably correlates to a certain horizon of the Lower member in the type Haidateyama area (HK 2), consists of alternation of sandstone and mudstone with intercalations of conglomerate. Another one probably corresponds to (HK 3) in the type area, sandstone and mudstone in alternation, with predominant shale at the top in the visible sequence. Neritic bivalves common in calcareous sandstone.

(3). Higashidani area. Lower limit faulted. About 680 m in thickness in visible sequence, mainly composed of sandstone, shale and their alternation, with partial interbeds of granule conglomerate. Neritic molluscan fossils found at two horizons of the shaly part. According to the paleontological evidence, the sequence probably represents the uppermost member of this formation (HK 4).

The stratigraphic positions of fossil localities and their guide map are shown in Text-figs. 2 and 3 respectively.

Paleontological description

Superfamily Ancylocerataceae MEEK, 1876

Family Ancyloceratidae MEEK, 1876

Genus *Ancyloceras* D'ORBIGNY, 1842

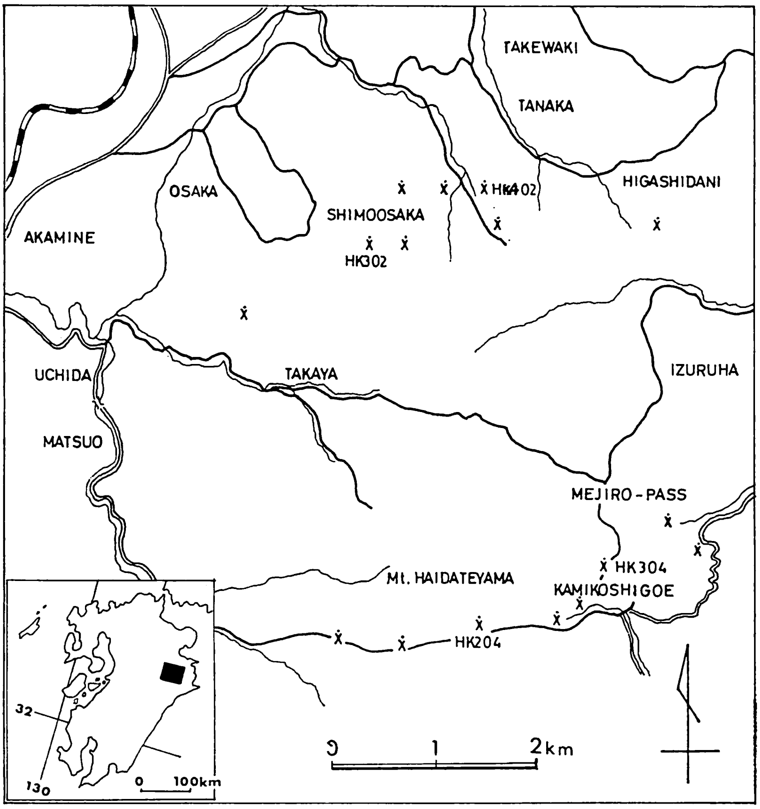
Subgenus *Ancyloceras* s. str.

Ancyloceras (*Ancyloceras*) sp.

aff. *Ancyloceras* (*Ancyloceras*) *vandenheckii* ASTIER

Pl. 44, Fig. 1a, b, c, d

Material — Only one specimen (GK. H10302) is concerned with description.



Text-fig. 3. Fossil localities of the Haidateyama Formation.

It is a fragmentary shaft, but the original ornaments and sutureline descernible.

Description—Open spiral shell with gradually enlarging shaft, fairly compressed secondarily. Shaft gently curved, probably oval in cross-section and widest at the umbilical tubercles. Trituberculate ribs rursiradiate and inequidistant. Ventrolateral and lateral tubercles nearly equally strong and larger than the umbilical ones, which are placed at about two thirds from the venter. Two or three intermediary ribs without tubercles constantly seen each interspace of the primary ones. Dorsal ribs fine, dense and bent forward. Two primary ribs and two intermediaries on the flank corresponding to five ribs on the dorsum; some dorsal ribs continue with the intermediaries, others bifurcated from the umbilical tubercle or simply intercalated. Sutureline complex, consisting of E, L, U and I, with bifid saddles and trifid lobes. U is smaller than I.

Comparison—The specimen closely resembles the hitherto described specimens of *Ancyloceras* (*Ancyloceras*) *vandenheckii* ASTIER, 1851 (see SARKER 1955, p. 136; THOMEL 1964, p. 54, pl. 8, figs. 1-5) from the Upper Barremian of Barrême, France, in the widely open spiral, the oval transverse section of shaft, the dense ribs on the dorsum and the rursiradiate trituberculate ribs and intermediaries on the flank. The distinction is in that ASTIER's specimen shows one or two intermediaries on each interspace, rapidly enlarging shaft and the lower position of umbilical tubercles situated at about three fourths from the venter. The present specimen, however, may be ascribed to a form of variation of that species considering the secondary deformation.

Ancyloceras (*Ancyloceras*) *mantelli* CASEY from the Lower Greensand of Atherfield, England, also resembles the present specimen in trituberculate ribs (CASEY, 1960). But the present specimen is not identified with that species which has rapidly enlarged shell height, one or two intermediaries on each interspace of the primary ribs, higher position of umbilical tubercles and prorsiradiate ribbing.

The illustration of *Ancyloceras* (*Ancyloceras*) *matheronianum* D'ORBIGNY (1842, p. 497, pl. 122) from the Lower Aptian of Bedoule, France, shows a widely open spiral, compressed cross-section and sutureline with bifid saddles and trifid lateral and dorsal lobes. In these characters the present specimen closely resembles the D'ORBIGNY's specimen but is distinguishable from it that has inequidistantly tuberculate ribs, less intermediaries and the higher position of the umbilical tubercles.

From the above comparison, the present specimen is not exactly identified with any of the previously described species of *Ancyloceras* s. str. It may represent a new species which is closely allied to *Ancyloceras* (*Ancyloceras*) *vandenheckii* ASTIER. As another alternative, it could be regarded as representing a variation of that species, but the number and preservation of the available specimens are insufficient.

Occurrence—Dark gray siltstone of the Lower member of the Haidateyama Formation. Locality: HK204, location; Long. 131°39′14″E, Lat. 32°56′47″N. On the southern slope of Mt. Haidateyama, Honjo Village, Minamiamabe County, Oita Prefecture. Together with *Neithea* (*Neithea*) *atava* RÖMER, *Gervillaria haradae* (YOKOYAMA), *Astarte* (*Astarte*) *subsenecta* YABE et NAGAO, *Ptycomya densicostata* NAGAO, *Goniomya subarchiaci* NAGAO, *Plectomya aritagawana* HAYAMI, *Nanonavis yokoyamai* (YABE et NAGAO), *Panopea* (*Myopsis*) *plicata* (SOWERBY), *Scittila japonica* HAYAMI, *Pterotrigonia hokkaidoana* (YEHARA), *Heteraster* sp. and *Paraheteraster* spp.

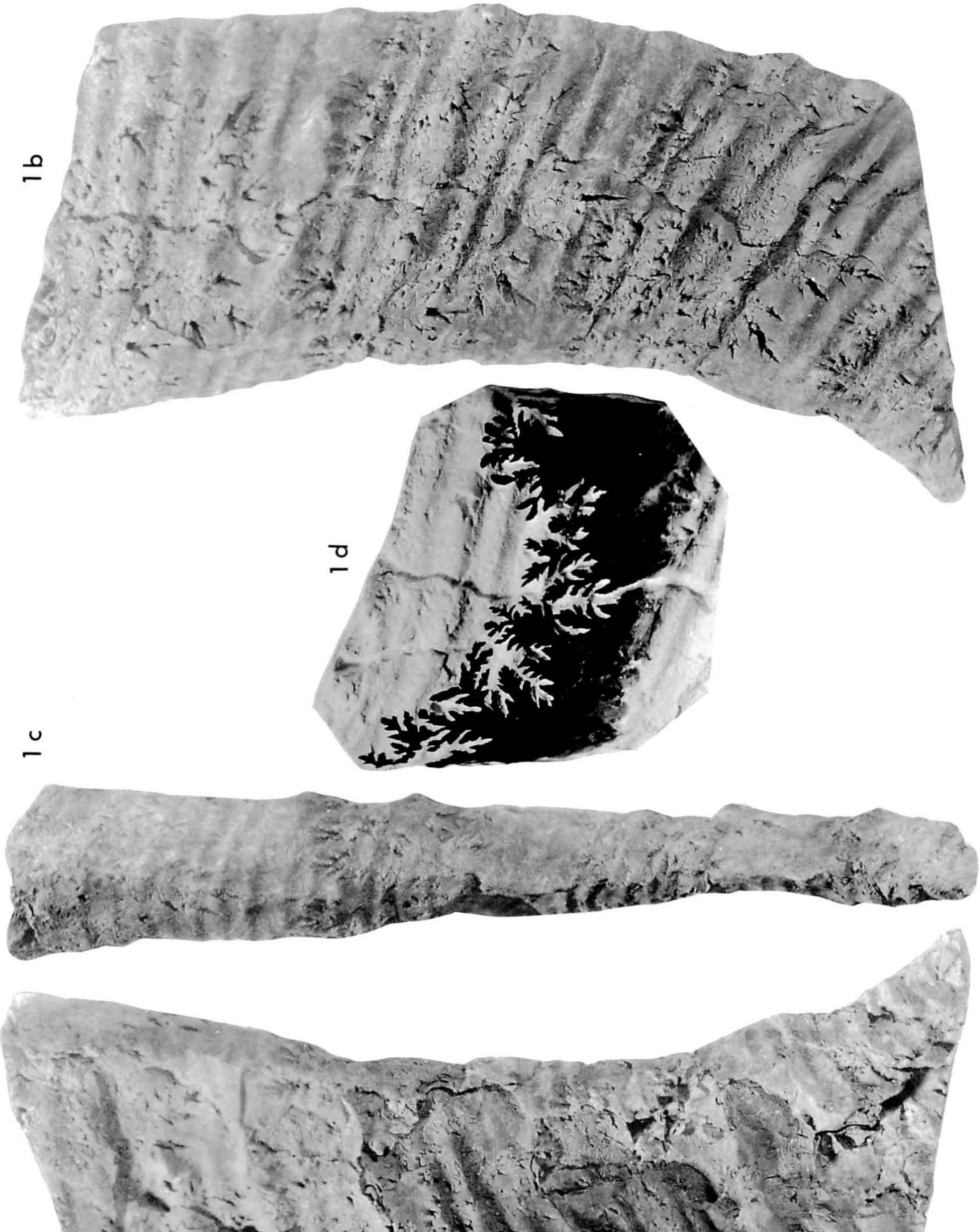
Note on geological age

FUJII (1954) correlated this formation with the Albian Yatsushiro Formation by means of the faunal assemblage. The species, however, were all of long ranging and there was no species which indicates the exact geological age of the formation. TERAOKA (1970) mentioned that the uppermost part of this formation may represent somewhat younger stage than that of the Yatsushiro Formation, according to the stratigraphic evidence.

Ancyloceras characterizes the age near

Explanation of Plate 43

Fig. 1a-d. *Ancyloceras* (*Ancyloceras*) sp. aff. *Ancyloceras* (*Ancyloceras*) *vandenheckii* ASTIER GK. H10302, natural size, internal mould from Loc. HK204 (coll. M. NODA, 1972). a: lateral view, b: opposite side of a, c: dorsal view, d: sutureline.



1a 1b 1c 1d

the boundary between the Barremian and Aptian as CASEY (1960) mentioned. *Ancyloceras* (*Ancyloceras*) *vandenheckii* ASTIER represents the uppermost part of the Barremian of Southeast France.

From the occurrence of *Ancyloceras* (*Ancyloceras*) sp. aff. *A.* (*A.*) *vandenheckii*, the age of the Lower member of the Haidateyama Formation is probably referred to the uppermost Barremian or the lowest part of the Aptian. The uppermost part of the Haidateyama Formation (Higashidani Formation by TERAOKA) containing *Neithea* (*Neithea*) *matsumotoi* HAYAMI probably belongs to the Albian.

TERAOKA (1970) reported the occurrence of *Cheloniceras* (?) sp. (preliminaly identified by MATSUMOTO) in the 2nd member of the Tamarimizu Formation which outcrops in a separate area to the northeast of Shiibaru, Notsu Town, faulted in several blocks. This fact may suggest the presence of the higher part of the Aptian in a certain portion of the successive sequence of the Haidateyama Formation.

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Akamine	赤 嶺	Onogawa	大 野 川
Haidateyama	佩 楯 山	Osaka	小 坂
Higashidani	東 谷	Shiibaru	椎 原
Honjo	本 匠	Shimoosaka	下 小 坂
Izuruha	出 羽	Takaya	高 屋
Kamikoshigoe	上 腰 越	Takewaki	竹 脇
Matsuo	松 尾	Tamarimizu	溜 水
Mejiro	目 白	Tanaka	田 中
Mie	三 重	Uchida	内 田
Minamiamabe	南 海 部	Usuki	臼 杵
Notsu	野 津	Wasadahigashi	稙 田 東
Ono	大 野	Yatsushiro	八 代

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668. PLIOCENE *MIZUHOPECTEN* FROM THE HIJI FORMATION OF THE OITA GROUP, OITA PREFECTURE, JAPAN*

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大分層群日出層産出の鮮新世 *Mizuhopecten* について：別府湾北岸の大分県日出町糸ヶ浜で大分層群下部の日出層（滝尾層相当層）から *Mizuhopecten tokyoensis hokurikuensis* を発見した。本層群上部（鶴崎層）からは海棲貝化石が知られていたが，下部からの海棲貝化石の産出は初めてである。この化石種を記載し，あわせて本亜種の生態分布および本層群の時代について考察した。 日高　稔

Introduction

The Upper Cenozoic Oita Group is exposed in the surroundings of Beppu Bay, Oita Prefecture, Kyushu. The stratigraphy of this group was previously reported by SHUTO (1953, 1962, 1970) and SHUTO et al. (1966). They assigned it to Pliocene to Pleistocene and correlated it with the Osaka Group of the Kinki province, but any leading fossil has not been known from its lower part in the type area, although its upper is defined biostratigraphically by the occurrence of *Stegodon orientalis* OWEN.

Recently the writer collected *Mizuhopecten tokyoensis hokurikuensis* (AKIYAMA), which has been found only in Lower Pliocene beds of Japan (sensu MASUDA, 1973a, b), from the lower part of the Hiji formation at Itogahara (Long. 131° 36′01″ E., Lat. 33°21′16″ N.), Hiji Town, Oita Prefecture.

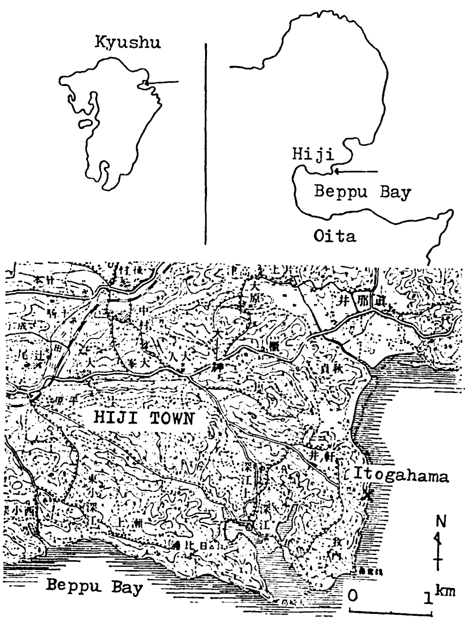
This paper deals with this subspecies with remarks on the geological age of the formation and paleobiological aspect.

* Received Sept. 18, 1976; read Oct. 19, 1974 at Nagoya.

Before going further, the writer wishes to express his sincere thanks to Professor Tsugio SHUTO of Kyushu University for his kind guidance and supervision of this study and also to Professor Zenzo MORIYAMA of Oita University for his constant encouragement. Sincere thanks are also due to Miss Masako OKAGUCHI of Kyushu University for kindly giving original information about the fission-track age determination of the Oita Group.

Stratigraphical setting of the fossil bed

The Oita Group is divided into the Takio and Tsurusaki Formations in ascending order in the type area, south of Beppu Bay (SHUTO, 1953). The Takio Formation is lithologically subdivided into three members, the Katashima, Hada and Shimogori Members in ascending order. The Katashima Member consists of the basal conglomerate and the overlying tuffaceous part with biotite and rhyolitic pumice and alternation of sand and silt. The Hada Member consists of rhyolitic pumice fall and flow in the lower



Text-fig. 1. Map showing the locality of *Mizuhopecten tokyoensis hokurikuensis* (AKIYAMA).

part and alternation of gravel, silt and tuffaceous sand with scattering hornblende-andesitic pumice in the upper part. The Shimogori Member is a thick sequence of tuffaceous sands and silts including two pyroxene-andesitic tuff breccias and tuffs. The Tsurusaki Formation, which lies conformably on the Takio Formation in the type section, is composed of gravels and sands with a rhyolitic tuff layer in the lower part and silts and sands with occasional gravel lenses in the upper part.

Some marine bands are intercalated in the upper parts of both the Katashima and Hada Members but do not yield any marine fossil except for rare occurrence of trace fossil. The Hada Member also yields such plant fossils as *Acer* sp. and *Glyptostrobus* sp., which do not serve for a detailed correlation. The Tsurusaki Formation contains marine molluscan fossils such as *Fulvia mutica* (REEVE), *Cyclina sinensis* (GMELIN), *Macoma incongrua* (MARTENS), *Proclva kochi* (PHILIPPI) in the upper part, but they do not indicate any precise age. It also yields *Stegodon orientalis* OWEN in the basal part, which was reported to range $4\sim5\times10^5$ yBP in the Kinki district (ISHIDA, 1970). Accordingly the age of the Oita Group in the type area is defined only for the upper horizon, i.e. the basal part of the Tsurusaki Formation.

The strata which are correlated volcano-stratigraphically to the Takio Formation are developed in the Hiji district, north of Beppu Bay. They are grouped lithostratigraphically into the Hiji and Oga Formations in ascending order.

The Hiji Formation consists of pale green tuffaceous sands, tuffaceous silts, pumiceous tuffs, tuff breccias and alternation of gravel, sand and silt with some

Table 1. Stratigraphy of the Oita Group in the marginal area of the Beppu Bay.

	South of Beppu Bay (Type area)		North of Beppu Bay
Oita G.	Tsurusaki F.	Takajo M.	missing
		Maki M.	
	Takio F.	Shimogori M.	Oga F.
		Hada M.	Hiji F.
		Katashima M.	

thin tuff beds in ascending order. The formation is characterized by hornblende-andesitic pyroclastics and corresponds to the Katashima and Hada Members of the Takio Formation. Fossil scallops, *Mizuhopecten tokyoensis hokurikuensis* (AKIYAMA), treated in this article were collected from this pale green tuffaceous sand bed, the lower part of the Hiji formation, together with many other marine mollusks as follows.

Acila divaricata (HINDS)
Portlandia lischkei (SMITH)
Mizuhopecten tokyoensis hokurikuensis (AKIYAMA)
Lucinoma annulata (REEVE)
Joannisiella cumingi (HANLEY)
Fulvia mutica (REEVE)
Macoma incongrua (v. MARTENS)
Myadora ikebei HABE
Panopea japonica A. ADAMS
Lunatia pallida (BRODERIP and SOWERBY)
Phos varicosus GOULD
Inquisitor pseudoprincipalis (YOKOYAMA)

The Oga Formation consists of tuffs, tuff breccias, tuffaceous sands yielding fresh water diatoms, gravels and alternation of tuff and tuff breccia in ascending order. The pyroclastic material of this formation is dominantly two pyroxene-andesitic and indicates the formation to correspond to a part of the Shimogori Member of the Takio Formation.

Geological age of the Oita Group

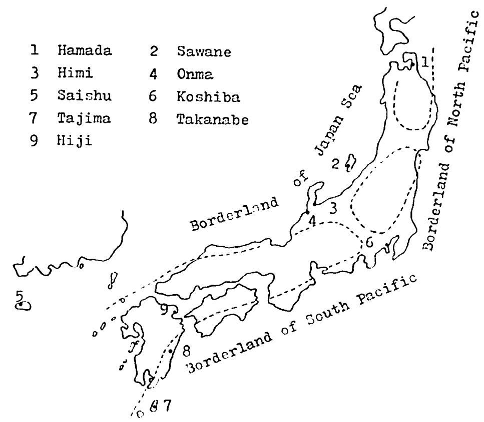
Discovery of *Mizuhopecten tokyoensis hokurikuensis* (AKIYAMA) from the Hiji Formation by the writer is a good aid for determining the geological age of the formation, because this subspecies shows very narrowly restricted range according to MASUDA (1962a, b, 1963, 1973b). He stated that the subspecies occurs only in the Lower Pliocene bed including the Hamada, Sawane, Himi, Onma, Saishu, Koshiba Formations and the Takanabe Member of the Kofu Formation. HAYASAKA (1973) added an occurrence of the subspecies in the Tajima Formation. The above localities are shown in Fig. 2. While the Himi and Onma Formation and the Takanabe Member are correlated respectively to the Upper Pliocene to Lower Pleistocene from the view point of the planktic microstratigraphy (IKEBE et al., 1973). Recently M. OKAGUCHI (MS, 1975) determined the fission-track age of zircon of Hada Pumice flow of the Hada Tuff of the Hada Member of the Takio Formation as $1.44 \pm 0.26 \times 10^6$ yBP. Volcano-stratigraphically speaking, the Hada tuff represents the latest activities of the biotite-hornblende-andesitic series in the Takio Formation. Consequently the scalop bed, the lowest part of the Hiji Formation must be older in age than the Hada tuff and may correspond to some marine bands of the upper part of the Katashima Member. She also gave a figure of $6.52 \pm 1.34 \times 10^6$ yBP concerning the Shikido pumice flow of the lower middle part of the Higashiwasada Formation, which unconformably underlies the Takio Formation. Under such circumstance as mentioned above the writer is inclined to correlate the scalop bed of the Hiji Formation and accordingly the upper part of the Katashima Member of the Takio Formation to Upper Pliocene through Lowest Pleistocene.

The basal part of the Tsurusaki Formation is correlated to the marine bands Ma 6 and Ma 7 of the Osaka Group in the Kinki province and to the Kasamori Formation of the Kazusa Group through the lowest Sagami Group in the Kwanto province on the basis of the common occurrence of *Stegodo orientalis* OWEN. The age of the basal part of the Tsurusaki Formation is within $4\text{-}5\times10^5$ yBP, Middle Pleistocene.

In conclusion the Takio Formation, the main part of the Oita Group, ranges from Upper Pliocene to Lower Pleistocene.

Paleobiogeography of *Mizuhopecten tokyoensis hokurikuensis* (AKIYAMA)

According to MASUDA (1962a, b, 1973a, b), the beds yielding *Mizuhopecten tokyoensis hokurikuensis* are sorted paleobiogeographically into two groups. The one, including the Hamada, Sawane, Himi, Onma, Saishu and Koshiba formations, all in the same age, belongs to the Borderland of the Japan Sea. The other one, including the Takanabe and Tajima, belongs to the Borderland of the South Pacific. *M. tokyoensis hokurikuensis* is associated with *Yabepecten tokunagai* (YOKOYAMA) and *Chlamys cosibensis* (YOKOYAMA) in the beds of the former group, while it occurs together with *Amussiopecten praesignis* (YOKOYAMA) and *Cryptopecten vesiculosus* (DUNKER) in the latter group. *Yabepecten tokunagai* is a representative species of the Pliocene pectinid in the Borderland of the Japan



Text-fig. 2. Localities of *Mizuhopecten tokyoensis hokurikuensis* (AKIYAMA) (Adapted from MASUDA, 1963 and 1973b).

Sea, and *Chlamys cosibensis* is regarded as one of the typical northern species ranging Middle Miocene to Pliocene in Northern Japan and the Japan Sea area, and also in the Alaskan Pliocene. *Amussiopecten praesignis* and *Cryptopecten vesiculosus* are the typical Pliocene and Pliocene to the Recent Kuroshio elements respectively. Association of *M. tokyoensis hokurikuensis* both with these cool and warm water assemblages may suggest its very labile ecological tolerance in regard to water temperature.

The present species is not accompanied by any pectinid species in the Hiji Formation, which is located between the two paleogeographical provinces above cited. It is a very interesting problem whether the Hiji area was connected with either cool or warm water in Upper Pliocene. A conclusion, however, can not be given concerning this problem, because *M. tokyoensis hokurikuensis* is associated neither with any pectinid nor typical element of cool or warm water in the Hiji Formation.

Habitat of *M. tokyoensis hokurikuensis* (AKIYAMA)

Distribution of the fossil valves of *M. tokyoensis hokurikuensis* in the Hiji Formation shows an apparent tendency that the small individuals occur in coarser sediment and the larger ones in finer sediment as shown in Table 2. This must not be a result of differential transportation during sedimentation, because large and heavy valves in silt and fine sand and small and light valves in coarser sand can not be explained by transportation effect. Besides, the associated bivalves suggest autochthonous or, at least, semiautochthonous by their sporadic occurrence, high percentage of conjoined valves and orientation of some individuals in situ.

According to AKIYAMA (1962), *Mizuhopecten yessoensis* (JAY) spends sessile life until the valve size attains about 10 mm in diameter in normal codition but retards the begining of free life until valves attain more than 30 mm in a quiet bay environment. This fact is very suggestive to understand the meaning of the occurrence of *M. tokyoensis hokurikuensis*. There must be a tendency to shift habitat from the area of coarse sand, where the young shells attach to sands with their byssus, to the area of finer sediments on which they live free life.

Systematic Description

Family Pectinidae

Subfamily Fortipectininae

Genus *Mizuhopecten* MASUDA, 1963

Mizuhopecten tokyoensis hokurikuensis (AKIYAMA, 1962)

Pl. 45, figs. 1-6

1935. *Patinopecten tokyoensis kimurai*, OTUKA, *Earthq. Res. Inst., Imp. Univ. Tokyo, Bull.*, vol. 13, no. 4, p. 887, pl. 57, fig. 212.

1960. *Patinopecten taiwanus*, SHUTO, *Mem. Fac. Sci., Kyushu Univ., Ser. D (Geol)*, vol. 9, no. 3, p. 125, pl. 12, figs. 2, 10, 11, pl. 14, figs. 7, 15.

1962. *Patinopecten (Patinopecten) tokyoensis hokurikuensis* AKIYAMA; AKIYAMA, *Sci. Rep., Tokyo Kyoiku Daigaku, Sec. C*, vol. 8, no. 74, p. 94, pl. 7, figs. 1-3, 5.

1962a. *Patinopecten (Patinopecten) tokyoensis hokurikuensis*; MASUDA, *Sci. Rep., Tohoku Univ., 2nd Ser. (Geol.)*, vol. 33, no. 2, p. 211, pl. 25, fig. 6, pl. 27, figs. 6, 7.

1963. *Mizuhopecten tokyoensis hokurikuensis*; MASUDA, *Trans. Proc. Paleont. Soc. Japan, N. S.* no. 52, p. 149, pls. 22-23.

1973. *Mizuhopecten tokyoensis hokurikuensis*; HAYASAKA, *Sci. Rep., Tohoku Univ., 2nd Ser. (Geol.)* Special vol., no. 6, p. 102, pl 6,figs. 1a, 1b.

Table 2. Occurrence of *M. tokyoensis hokurikuensis* (AKIYAMA) in relation to the shell size and to the grain-size of the sediment.

Height of the Shell	Sediment of the Scalop Bed			
	Silt	Fine Sand	Medium Sand	Coarse Sand
6 cm≦	1	2		1
2 cm～6 cm		1	5	4
2 cm≧				5

Materials: Nineteen specimens collected from the Hiji Formation at Itogahama, most of which are incompletely preserved, are available. All the specimens are kept in the Institute of Geology, Faculty of Education, Oita University. Six specimens of them are well preserved, OH-5~9 and OH-10 are shown in the plate.

Dimensions:

Specimen	OH-5	OH-6	OH-7	OH-8	OH-9	OH-15
Valve*	R.	R.	R.	R.	R.	L.
Height (mm)	17.5	25.5	28	35	—	—
Length (mm)	17	24.5	28	35	—	—
Hinge length (mm)	12.5	18.5	—	21	52	35
H/L(%)	102	104	100	100	—	—
Apical angle	99°	100°	100°	102°	103°	102°
Number of ribs	5	6	7	6	6	6

* (R; Right, L; Left)

Description: Shell medium to large in size, orbicular in outline, equilateral except for auricles, equivalve with moderately convex right and somewhat less convex left as high as long or slightly higer than long, and radiately ribbed. Apical angle rbout 100 degrees. Right valve moderately inflated, with 5 to 6, broard, rather prominent, round topped, smooth radial ribs and fine and dense concentric growth lines. Radial ribs much broader than interspaces and becoming relatively narrower toward ventral margin; interspaces with network sculpture on upper part of disc. Auricle truncated at both ends, with a broad and shallow byssal notch at anterior base; a few radial threads, fine concentric lines and distinct network, anterior truncation acutely oblique on small valves and almost right angle on large ones. Left valve almost flat, with six, elevated, roof-shaped but not so sharply ridged radial ribs, dense concentric growth lines and distinct fine network. Auricle equilateral with similar sculpture to the right valve. Hinge line straight, long, as long as about sixty to seventy percent of shell length; hinge with simple and rather sharp cardinal crurae on both sides of a wide and deep resilial pit. Pit bordered by fine lateral ridge with small but rather distinct denticle at extremities. Inside of discs smooth except for radial relief reflecting surface ribs.

Comparison and affinity: Mizuhopecten MASUDA, 1963, is characterized primarily by its hinge with simple cardinal crurae and a wide and shallow resilial pit bordered by lateral ridges and secondly by equilateral auricle with shallow and broad byssal notch. In these respects the genus is readily distinguished from such allied genera as *Patinopecten* DALL, 1898 and *Yabepecten* MASUDA, 1963. The specimens in hand clearly show these diagnostic features, and are reasonably assigned to *Mizuhopecten.* The morphological features of the present subspecies were fully described by AKIYAMA (1962) and MASUDA (1962a). The present material are featured by moderate to large shell and the paucity of ribs and also network on valves, and are identified to *Mizuhopecten tokyoensis hokurikuensis* (AKIYAMA). The present specimens show a fair affinity with *Mizuhopecten tokyoensis* (TOKUNAGA), but the former can be distinguished from the latter by the more inflated right valve, round-topped non-branching and less numerous radial ribs, and also by nearly flat left valve with distinctly elevated roof shaped radial ribs. Comparing with *Mizuhopecten kimurai* (YOKOYAMA), which shows rather resembled ribbing, the present specimens have distinctly larger auricles.

Horizon: Pale green tuffaceous sand of the lower part of the Hiji Formation, Oita Group. Upper Pliocene.

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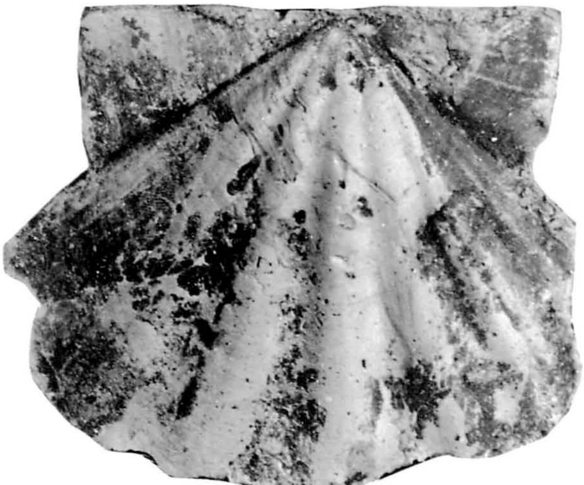
Explanation of Plate 45

Mizuhopecten tokyoensis hokurikuensis (AKIYAMA)

Fig. 1. Rubber cast of right external mould (OH-9) ×1.2
Fig. 2. Rubber cast of right internal mould (OH-5) ×2.1
Fig. 3. Rubber cast of left external mould (OH-15) ×1.7
Fig. 4. Rubber cast of right internal mould (OH-8) ×1.7
Fig. 5. Rubber cast of right internal mould (OH-7) ×1.8
Fig. 6. Rubber cast of right internal mould (OH-6) ×2.4



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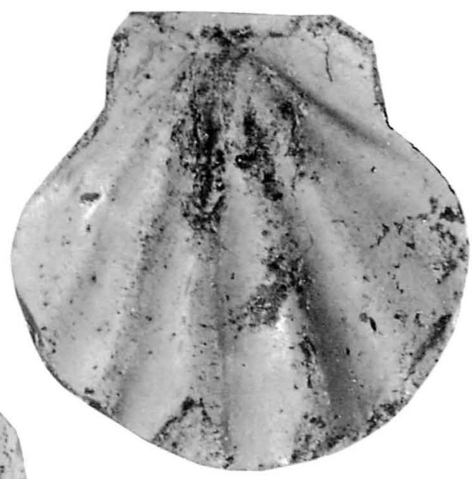

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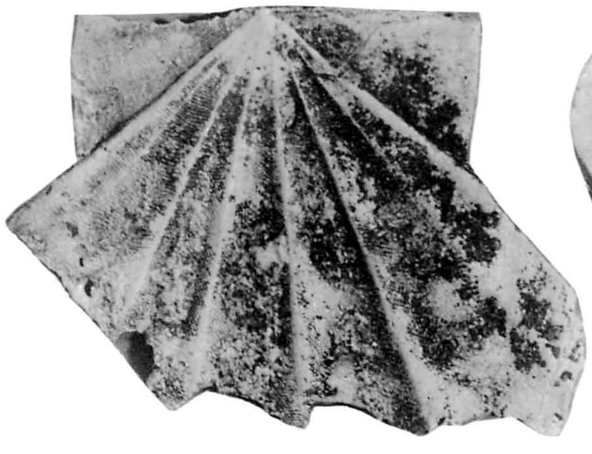

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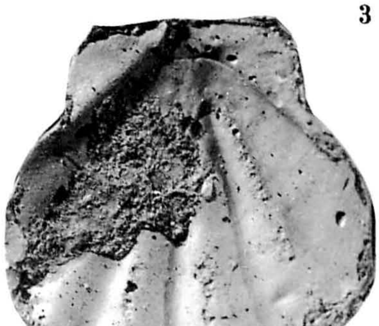

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Beppu	別 府	Oga	大 神
Hada	羽 田	Shimogori	下 郡
Hiji	日 出	Takio	滝 尾
Itogahama	糸ケ浜	Tsurusaki	鶴 崎
Katashima	片 島		

Trans. Proc. Palaeont. Soc. Japan, N.S., No. 104, pp. 432-441, pls. 46, 47, Jan. 20, 1977

669. FOSSIL *PEDIASTRUM* FROM THE PLEISTOCENE HAMAMATSU FORMATION AROUND LAKE HAMANA, CENTRAL JAPAN*

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浜名湖周辺佐浜泥層より得た浮游性緑藻類クンショウモ属について： 浜名湖北東岸館山寺付近に分布する洪積統佐浜泥層から得られたクンショウモ属 (*Pediastrum*) 4種を記載した。そのなかで, *Pediastrum simplex* (MEYEN) LEMMERMANN について *P. biwae* NEGORO と比較・検討した結果, 1新亜種が識別された。またこれらの微化石と共産した珪藻には淡水棲種および海棲～汽水棲種が混在しており, また軟体動物化石も半鹹半淡水種の報告があることから, 当地域の佐浜泥層は河口に近い汽水域で堆積したと推定される。 松岡数充・長谷憲治

Introduction

In the course of palynological study of the Pleistocene sediments distributed around Lake Hamana, well preserved *Pediastrum* fossils belonging to the Family Hydrodictaceae, Class Chlorophyceae were abundantly obtained.

In Japan, the occurrence of fossil Hydrodictaceae such as *Paleodictyon tenue* KORIBA and MIKI, *P. robstum* KORIBA and MIKI and *Hydrodictyon tertiarum* KORIBA and MIKI was first described by KORIBA and MIKI (1939) from the Cretaceous to Paleogene sediments, the Shimanto Supergroup in Kii Peninsula. These fossils, however, have been said to be inorganic in origin or feeding trail fossils (HARATA, 1969). On the other hand, a few paleo-palynologists have reported the occurrence of *Pediastrum*, one of planktic green algal genera, including following species; *Pediastrum boryanum* (TURPIN) MENEGHINI, *P. duplex* MEYEN and *P. biwae* NEGORO from the Plio-Pleistocene Osaka Group (NASU, 1970, SHIMAKURA 1971); *Pediastrum biwae* and *P. duplex* from the Plio-Pleistocene Paleo-Biwa Group (NASU, 1970); *Pediastrum* sp. from the Pleistocene Hamamatsu Formation (SHIMAKURA, 1964); *Pediastrum* cf. *P. boryanum* from the Pliocene Nobori Formation and the Miocene Fujiwara Group (MATSUOKA, 1971, 1974); *Pediastrum araneosum* RACIBORSKI, *P. boryanum* and *P. kawraisky* SCHIDLE (Resarch group for the Hiruzenbara, 1975).

The palynological study of the Quaternary deposits around Hamamatsu City was carried out by SHIMAKURA (1964). And he repoted the first finding of *Pediastrum* in silty samples collected from the southern area of Inasa and Shiroyamabana.

* Received Sept. 20, 1976; read Sept. 23, 1975 at Kanazawa.

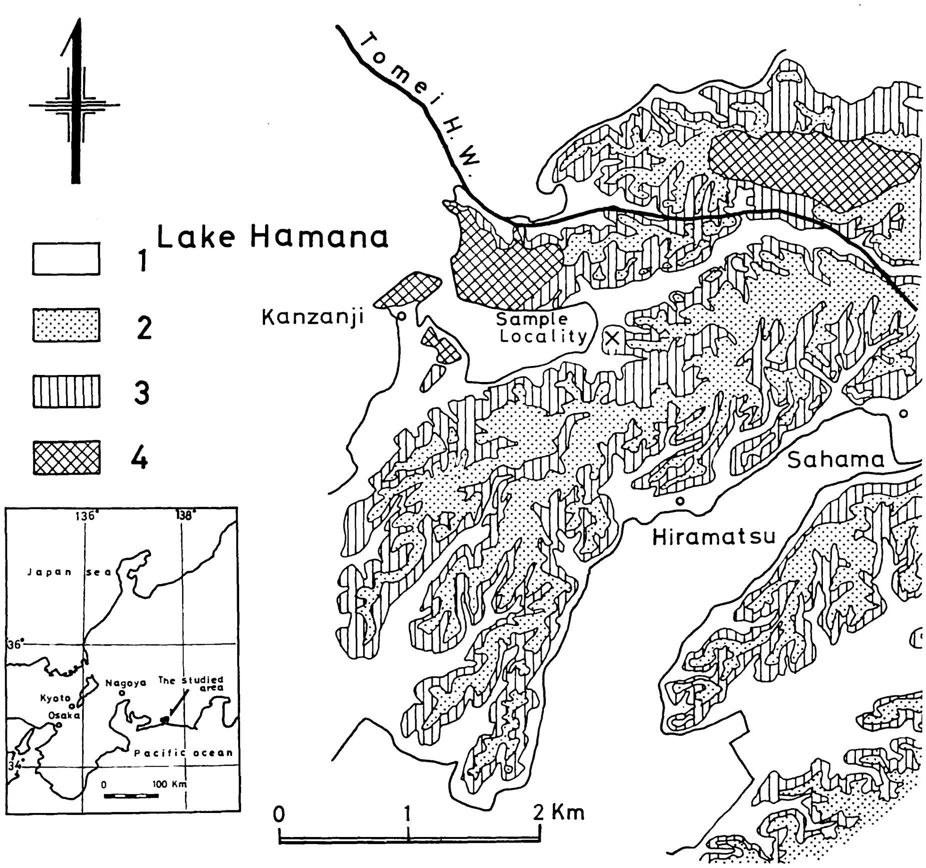
In this paper, the writers will describe four species of the genus *Pediastrum* obtained from the Hamamatsu Formation and discuss on the paleo-environments of this formation on the basis of diatom and molluscan fossils.

Acknowledgement

The writers' sincere gratitude is expressed to Professor Kazuo HUZITA and Professor Shohei KOKAWA of Osaka City University for their kind encouragements. The senior writer thanks deeply to Professor Ken-ichi NEGORO of Kinki University for his kindness in idintifying fossil diatoms. Thanks are also due to Professor Misaburo SHIMAKURA of Kansai Foreign Language University and Professor Kozo HIROSE of Kobe University who gave many valuable suggestions about algal fossils to the senior writer.

Geological note and preparation method

The geological aspect around Lake Hamana in Central Japan is summarized



Text-fig. 1. Geological map of the northeastern coast of Lake Hamana. 1; Recent deposit, 2; Mikatagahara Formation, 3; Sahama muddy member of the Hamamatsu Formation, 4; Basement paleozoic rocks.

by KOBAYASHI (1963) as follows:

The basement rocks in the present area are Paleozoics and mostly composed of sandstone and chert intercalated with small limestone and greenstone lenses. They are exposed in hilly lands on the northern part of this lake and near Kanzanji as small inlier masses.

The lower to middle Pleistocene Hamamatsu Formation covering directly these Paleozoics consists of sand, mud and gravel beds accompanied by a few thin volcanic ash layers. It is subdivided into three facies lithologically. The part of the muddy facies is named the Sahama muddy member (TSUCHI, 1960). It yields abundant macro- and microfossils such as foraminifers, sponge spicules, molluscs, diatoms, dinoflagellate cysts, acritarchs, spores, pollen grains and larger plant remains.

The Mikatagahara Formation covers disconformably the Hamamatsu Formation and makes the surface of the upland of Mikatagahara. This formation consists wholly of fluviatile graveliferous deposits.

The samples provided for the analysis were collected from the Sahama muddy member near Kanzanji along the eastern coast of the lake, in which some molluscs were contained sporadically.

The SHIMAKURA's method was adopted for the present palynological investigation.

The specimens described in this paper are deposited in the Laboratory of Paleobotany, Osaka City University.

Notes on paleo-environment of the Hamamatsu Formation

As previously mentioned elsewhere the *Pediastrum* fossils have been reported in the sedimentary facies from freshwater to marine. For example, some *Pediastrum* species were found from marine sediments in Pakistan (Lower Cretaceous) and in California (upper Cretaceous) by EVITT (1963), while the fossils occurred in the freshwater Pleistocene sediments known as gyttja in northern Europe (FAEGRI and IVERSEN, 1950).

Here the sedimentary environment of the Hamamatsu Formation with a large amount of *Pediastrum* near Kanzanji is discussed on the basis of diatom and molluscan occurrence.

Diatom assemblage

Fossil diatoms distinguished in the same samples from the Hamamatsu Formation is listed in Table 1.

Table 1. Fossil diatoms accompanied with the mentioned *Pediastrum* spp.; identified by K. NEGORO.

Actinocyclus ehrenbergi Grun.*	A
Actinoptycus splendens (Shadb.) Ralfs.*	F
Arachnoidiscus ehrenbergi Bail.*	R
Campyrodiscus echeneis Ehr..*	C
Cocconeis placentula Ehr.	F
Coscinodiscus lacustris Grun.*	C
Cymatopleura elliptica (Beil.) W. Smith	R
Cymbella lanceolata (Ehr.) Van Heurck	C
Cymbella lata Grun.	F
Cymbella tumida (Bréb.) Van Heurck	F
Diploneis interrupta (Kütz.) Cleve*	R
Diploneis ovalis (Hilse) Cleve	R
Epithemia trugida (Ehr.) Kutz.	A
Epithemia trugida var. *granulata* (Ehr.) Grun.	A
Eunotia pectinalis (Bréb.) Grun.	R
Gomphonema acuminatum var. *cornata* (Ehr.) W. Smith	R
Gomphonema gracile var. *lanceolata* (Küzt.) Cleve	R
Gyrosigma acuminatum (Küzt.) Rabh.	F
Hydrosera triquetra Wall.	R
Melosira italica (Ehr.) Küzt.	F
Nitzschia circumsuta (Bail.) Grun.*	A
Pinnularia maior (Kütz.) Cleve	R
Pinnularia viridis (Nitzsch) Ehr.	R
Rhopalodia gibba (Ehr.) O. Mull.	R
Stauroneis phoenicenteron Ehr.	R
Surirella biseriata Bréb.	R
Surirella robusta Ehr.	F
Triceratium favus Ehr.*	R

*: brackish to marin species

A: abundant, C: common, F: a few, R: rare

In this assemblage, *Actinocyclus ehrenbergi*, *Actinoptychus splendens*, *Arachnoidiscus ehrenbergi* and *Coscinodiscus lacustris* belonging to the centrales are marine to brackish species. On the other hand, *Cymbella lanceolata*, *Epithemia trugida*, *E. trugida* var. *granulata*, *Diploneis interrupta* and *Nitzschia circumsuta* belonging to the pennales are freshwater species. Other pennatae species, *Campylodiscus echeneis*, is brackish species. *Epithemia trugida*, *Nitzschia circumsuta* and *Actinocyclus ehrenbergi* are the dominant species and followed by *Campylodiscus echeneis*, *Coscinodiscus lacustris* and *Cymbella lanceolata*. This diatom assemblage, therefore, is characterized by co-existence of marine to brackish and freshwater species. Furthermore, there is no specimens such as *Melosira solida* and *Stephanodiscus cariconensis* indicating the water system of Lake Biwa (NEGORO, 1954) in the Kinki district.

Molluscan assemblage

According to ISOMI and INOUE (1972), the molluscan fossil assemblage around the present sampling area is characterized by the abundant occurrence of *Corbicula japonica* and *Gryphera gigas* which indicate an estuarine facies.

Judging from both diatom and molluscan fossil assemblages, the Hamamatsu Formation yielding abundantly *Pediastrum* spp. might be formed near the mouth of a river strongly influenced by sea water. Then *Pediastrum* spp. are considered to have been transported from some lakes or ponds near Paleo-Hamana Bay.

Pediastrum biwae, an endemic species in Lake Biwa, could be collected from the surface water in Osaka Bay near mouth of the River Yodo (ZORIKI and HIROSE, 1975). It must have been transported from Lake Biwa through the Rivers Seta, Uji and Yodo. This may afford a good reason to expect the above-mentioned Pleistocene environment around Lake Hamana.

Systematic description

By K. MATSUOKA

Division Chlorophyta

Class Chlorophyceae

Order Chlorococcales

Family Hydrodictaceae

Genus *Pediastrum* MEYEN, 1829

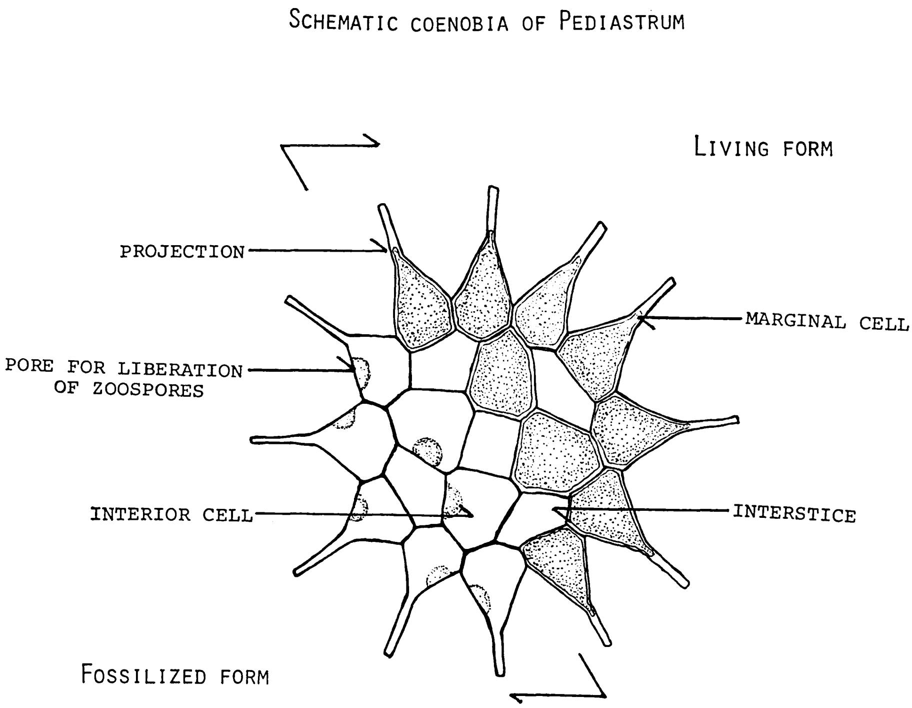
Pediastrum araneosum RACIBORSKI
var. *rugulosum* (G. S. WEST)
G. M. SMITH, 1920

Pl. 47, figs. 9-13

Pediastrum araneosum RACIBORSKI var. *rugulosum* (G. S. WEST) G. M. SMITH 1920, p. 168, pl. 45, figs. 12, 13.

Description: The coenobium consisting two different types of cells shows circular to oval in shape, and has no interstices between interior cells. The coenobium is mostly composed of 32-64 cells. The marginal cells have two short and truncated projections. Inner half of the marginal cells are convex in shape, and outer half of them have a slightly deep emargination between their projections. The interior cells have five to six sides, and a pair of opposite two of them is convex and concave respectively. Others have straight sides. The surface of cells is covered with coarse reticulatum of ridges.

Dimension: Diameter of coenobia (32 cells) $105\,\mu$-$145\,\mu$, length of interior cells



Text-fig. 2. Terminology and schematic coenobia of *Pediastrum*.

9 μ-11 μ, width of them 14 μ-22 μ, length of marginal cells 17 μ-19 μ, width of them 25 μ-29 μ.

Remarks: The present variety differs from others in characteristic cell surface. The projections from the marginal cells in these specimens are somewhat longer than in the specimens figured by G. M. SMITH (1920, pl. 45, figs. 12, 13).

Pediastrum duplex MEYEN var. *coharens* BOHLIN 1897

Pl. 47, figs. 5-8

Pediastrum duplex MEYEN var. *coharens* BOHLIN 1897, p. 31, pl. 2, fig. 1.

Pediastrum duplex MEYEN var. *reticulatum* LAGERHEIM forma *coharense* (BOHLIN) BRUNNTHALER 1915, in PASCHER (edt.), p. 95, fig. 57e.

Pediastrum duplex MEYEN var. *coharens* BOHLIN; G. M. SMITH, 1920, p. 173, pl. 48, figs. 3, 4.

Description: The present coenobium is elliptical to oval and usually composed of 16-32 cells with two different types. There are many various interstices in shape and in size among interior cells. The marginal cells have two characteristically distinctive subconical projections. Inner half of the marginal cells is convex in shape. The interior cells are generally similar to the marginal cells with the exception of their projections. The cell surface is covered with coarse granular ornamentation. The coenobia are scarcely stained with safranin solution.

Dimension: Diameter of coenobia (32 cells) 87 μ-120 μ, length of interior cells 11 μ-16 μ, width of them 16 μ-20 μ, length of marginal cells 18 μ-20 μ, width of them 14 μ-16 μ.

Remarks: Though the specimens from the Hamamatsu Formation are relatively poor in preservation, they differ from *Pediastrum boryanum* in having many interstices. This variety is characterized also by the presence of coarse granular ornamentation on the cell surface.

Pediastrum boryanum (TURPIN) MENEGHINI 1840

Pl. 47, figs. 1-4

Pediastrum boryanum (TURPIN) MENEGHINI 1840, p. 210.

Pediastrum boryanum (TURPIN) MENEGHINI; G. M. SMITH, 1920, p. 169, pl. 46, figs. 2-7.

Description: The slightly small coenobium consisting of two different types of cells shows circular to oval in shape without interstices among interior cells. The coenobium is usually composed of 32 cells in the present specimens. Its marginal cells have two tapering and long projections, and deep emargination between the projections. Inner half of marginal cells is convex in shape. Interior cells have five to six sides and a pair of opposite two of them is convex and concave respectively. Others have straight sides. The surface of all cells is covered with fine granular ornamentation.

Dimensions: Diameter of coenobia (32 cells) 74 μ-101 μ, length of interior cells 8 μ-15 μ, width of them 11 μ-18 μ, length of marginal cells 17 μ-20 μ, width of them 12 μ-17 μ.

Remarks: The present species is existent almost universally in Recent lakes and ponds. In Japan a few fossilized specimens were reported from the Pleistocene sediments (SHIMAKURA ed., 1971).

Pediastrum simplex (MEYEN) LEMMERMANN 1898

Pediastrum simplex (MEYEN) LEMMERMANN; BRUNTHALER 1915, in PASCHER (ed.), p. 93-94, figs. 55, 56.

Remarks: Pediastrum simplex is characterized by having only one projection on each marginal cell. Some varieties of this species such as var. *duodenarium* and var. *radians* have interstices between cells. *Pediastrum biwae* described by NEGORO (1954) from Lake Biwa closely resembles the present species. The former is distinguishable from the latter in the presence of characteristic projections; the projections from two adjacent marginal cells that face to or separate from each other.

Pediastrum simplex (MEYEN) LEMMERMANN var. *duodenarium* (BAILEY) RABENHORST, 1868

Pl. 46, figs. 6-12, Pl. 47, fig. 14

Pediastrum simplex MEYEN var. *doudenarium* (BAILEY) RABENHORST, 1868, p. 72.

Pediastrum simplex var. *duodenarium* (BAILEY) RABENHORST; G. M. SMITH, 1920, p. 167, pl. 45, figs. 2-6.

Description: The present coenobium is circular to oval in shape, and usually made up of 16-32 cells with two different types. There are many interstices among interior cells. The marginal cells with a single conspicuous projection is an isosceles triangular in outer part. The basal part of them is irregularly pentagonal in shape. The distal part of its projection is oblate and of smooth surface. Except for the distal part all cells are covered with relatively coarse granular ornamentation. The interior cells are generally an isosceles triangular with three concave sides except for each apex. Therefore, the interstices show a convex polygonal shape. Marginal and interior cells have a pore with an almost circular outline for liberation of zoospores.

Dimension: Diameter of coenobia (32 cells) 97μ-107μ, length of interior cells 13μ-20μ, width of them 10μ-16μ, length of marginal cells 16μ-26μ, width of them 10μ-15μ.

Remarks: This variety is very similar to *Pediastrum biwae* var. *biwae* NEGORO in the shape of marginal and interior cells. But the nature of two adjacent projections in this variety is different from that of *P. biwae* var. *biwae*. This variety is most abundant in the mentioned *Pediastrum* population.

Pediastrum simplex (MEYEN) LEMMERMANN var. *inflatum* MATSUOKA, var. nov.

Pl. 46, figs. 1-5

Diagnosis: Marginal cells roundish isosceles triangular with distal oblate projections. Interior cells roundish regular triangnlar with three convex sides. Therefore, interstices are concave in polygonal shape.

Holotype: Slide no. KMD-3, position 18.8×90.3, Pl. 46, fig. 1.

The Pleistocene Hamamatsu Formation near Kanzanji, Hamamatsu City, Shizuoka Prefecture.

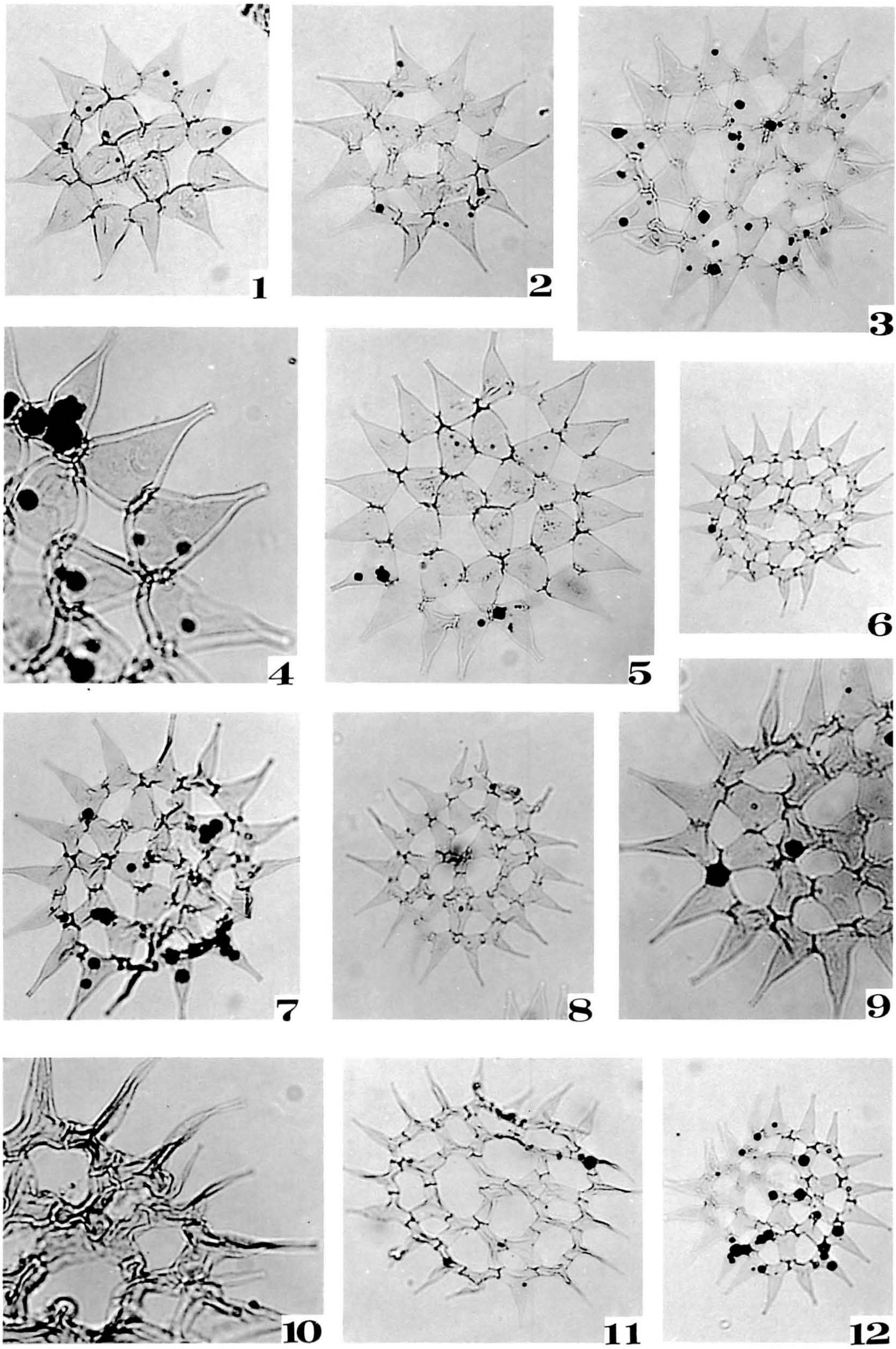
Paratype: Slide no. KMD-2, position 16.5×99.8, Pl. 46, fig. 2. Slide no. KMD-1, position 23.8×99.6, Pl. 46, fig. 5.

Description: The present coenobium is circular to oval in shape, and usually composed of 16-32 cells with two different types. There are many characteristics interstices among interior cells. The marginal cells with concave line on interior side is roundish isosceles triangular in shape. The relatively long projection is oblate and with smooth surface. Except for the projection, all cells including interior cells are covered with coarse granular ornamentation. The interior cells are generally regular triangular with three convex sides except for each apex. Therefore, the interstices show a concave polygonal shape. Each cell has a pore with an almost circular outline for liberation of zoospores.

Explanation of Plate 46

Figs. 1-5. *Pediastrum simplex* (MEYEN) LEMMERMANN var. *inflatum* MATSUOKA, n. var.
- Fig. 1. Holotype, Slide no. KMD-3, position 18.8×90.3, ×335.
- Fig. 2. Paratype, Slide no. KMD-2, position 16.5×99.8, ×335.
- Fig. 3. Slide no. KMD-2, ×335.
- Fig. 4. Slide no. KMD-1, ×670.
- Fig. 5. Paratype, Slide no. KMD-1, position 23.8×99.6, ×335.

Figs. 6-12. *Pediastrum simplex* (MEYEN) LEMMERMANN var. *duodenarium* (BAILEY) RABENHORST
- Fig. 6. Slide no. KMD-1, ×335.
- Fig. 7. Slide no. KMD-4, ×335.
- Fig. 8. Slide no. KMD-5, ×335.
- Fig. 9. Slide no. KMD-4, ×670.
- Fig. 10. Slide no. KMD-5, ×670.
- Fig. 11. Slide no. KMD-5, ×335.
- Fig. 12. Slide no. KMD-3, ×335.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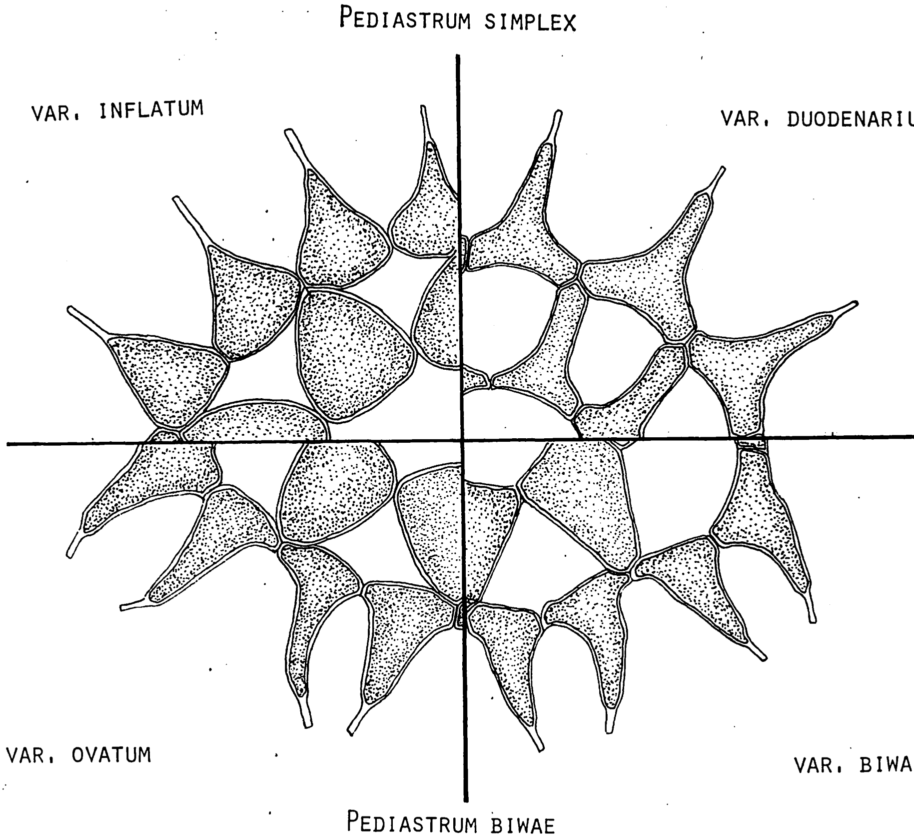

Text-fig. 3. Morphological correlation between *Pediastrum simplex* and *P. biwae*; showing differences of projections and interior cells.

Dimension: Holotype; diameter of coenobium 120 μ, length of interior cells 18μ-22μ, width of them 16μ-21μ, length of marginal cells 34 μ-37 μ, width of them 15 μ-20 μ, diameter of liberation pores ca. 7 μ.

Range in dimension; diameter of coenobia (16 to 32 cells) 98 μ-153 μ, length of interior cells 16 μ-25 μ, width of them 14 μ-22 μ length of marginal cells, 19 μ-40 μ, width of them 12 μ-21 μ.

Remarks: The present variety of *Pediastrum simplex* closely resembles *P. biwae* var. *ovatum* NEGORO in the shape interstices and interior cells. Though these mophological affinities are observed between *P. simplex* var. *duodenarium* and *P. biwae* var. *biwae*, the nature of two adjacent projections is different from each other. The shape of marginal and interior cells distinguishes this variety from *P. simplex* var. *duodenarium*.

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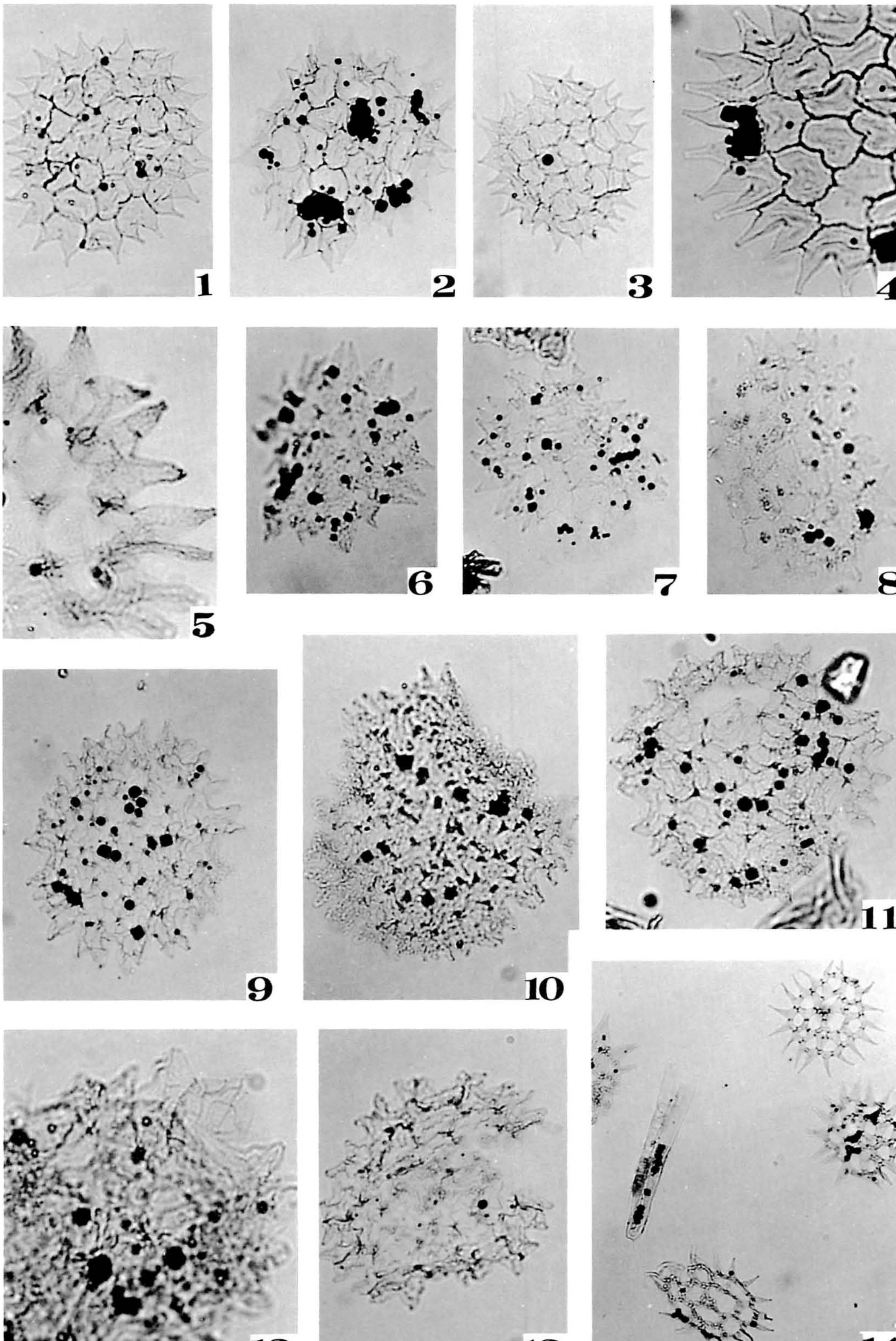
Explanation of Plate 47

Figs. 1-4. *Pediastrum boryanum* (TURPIN) MENEGHINI
- Fig. 1. Slide no. KMD-1, ×335.
- Fig. 2. Slide no. KMD-5, ×335.
- Fig. 3. Slide no. KMD-3, ×335.
- Fig. 4. Slide no. KMD-1. ×670.

Figs. 5-8. *Pediastrum duplex* MEYEN var. *coharens* BOHLIN
- Fig. 5. Slide no. KMD-1, ×670.
- Fig. 6. Slide no. KMD-4, ×335.
- Fig. 7. Slide no. KMD-3, ×335.
- Fig. 8. Slide no. KMD-3, ×335.

Figs. 9-13. *Pediastrum araneosum* RACIBORSKI var. *rugulosum* (G. S. WEST) G. M. SMITH
- Fig. 9. Slide no. KMD-1, ×335.
- Fig. 10. Slide no. KMD-4, ×335.
- Fig. 11. Slide no. KMD-4, ×335.
- Fig. 12. Slide no. KMD-5, ×670.
- Fig. 13. Slide no. KMD-1, ×335.

Fig. 14. *Pediastrum simplex* (MEYEN) LEMMERMANN var. *duodinarium* (BAILEY) RABENHORST
Slide no. KMD-5, ×170.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*: in Japanese.

Biwa	琵　琶	Mikatagahara	三方ヶ原
Hamana	浜　名	Osaka	大　阪
Kanzanji	館山寺	Sahama	佐　浜
Kii	紀　伊	Seta	瀬　田
Kinki	近　畿	Yodo	淀

Trans. Proc. Palaeont. Soc. Japan, N.S., No. 104, pp. 442-447, pl. 48, Jan. 20, 1977

670. TWO CARBONIFEROUS CORALS DISCOVERED FROM MITSUZAWA, SOUTHEASTERN PART OF THE KWANTO MASSIF*

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関東山地南東部三ツ沢産石炭紀珊瑚化石2種について：東京都下武蔵五日市町北方約6 km の三ツ沢から坂上澄夫によって採集された珊瑚化石を研究し，*Lithostrotion* (*Siphonodendron*) *mitsuzawensis*, n. sp. および *Ozakiphyllum* ? sp. indet. の2種を識別，記載すると共に，その産出層準の時代には early Namurian の可能性があることを述べた。この論文は坂上澄夫 (1973) Early Carboniferous Visean Faunas from Mitsuzawa, southeastern part of the Kwanto massif の part 3 に相当するものであるが，珊瑚化石の研究からみると，その時代は Visean よりも early Namurian とする方が妥当と考えられる.

山際延夫

Two interesting coral species *Lithostrotion* (*Siphonodendron*) *mitsuzawensis*, n. sp. and *Ozakiphyllum* ? sp. indet., in this article were collected by SAKAGAMI from the Mitsuzawa limestone in the southeastern part of the Kwanto massif.

This fossil fauna including gastropods, brachiopods, corals, bryozoans and crinoid stems was discovered by SAKAGAMI (1972) from the Mitsuzawa limestone. Of them, the gastropods were described already by SAKAGAMI (1973) and the brachiopods by YANAGIDA (1973) respectively. According to them, this fauna is referable to Late Visean in age. Later IGO and KOBAYASHI (1974) found rich conodonts from the limestone, and they concluded that the geological age should be early Namurian.

Lithostrotion (*Siphonodendron*) *mitsuzawensis*, n. sp. resembles the following species: *Lithostrotion* (*Siphonodendron*) *hidense*, *L.* (*S.*) *nakazawai*, *L.* (*S.*) *yaolingense*, *L.* (*S.*) *pauciradiale*, *L.* (*S.*) *martini* and *L.* (*S.*) *pseudomartini*. *Lithostrotion* (*Siphonodendron*) *hidense* was described by KATO (1959a) from the *Siphonodendron hidense* zone in the Ichinotani formation, Hida massif. From the data of many corals, he assumed that this zone ranges from late Visean to early Namurian in age (KATO, 1959b). According to the fusulinid study of the Ichinotani formation (IGO, 1959), *Eostaffella kanmerai* subzone that is correlated to the *Siphonodendron hidense* zone belongs to late Visean (possibly extending to early Namurian). *Lithostrotion* (*Siphonodendron*) *nakazawai* was described by MINATO and KATO (1957) from a boulder in the conglomerate of the Permian Maizuru group; this species is similar to some of *Lithostrotion* (*Siphonodendron*) from the Upper Visean of China. *Lithostrotion* (*Siphonodendron*) *yaolingense* was found in the Upper Visean of China (CHU, 1928), *L.* (*S.*) *pauciradiale* in the Upper Visean of

* Received July 7, 1976; read October 28, 1972 at Matsuyama.

Japan, China and Europe (PHILLIPS, 1843; EDWARDS and HAIME, 1852; KUNTH, 1869; YÜ, 1933; HILL, 1940; MINATO, 1955), *L.* (*S.*) *martini* in the Upper Visean of Japan, Europe and Africa (EDWARDS and HAIME, 1852; THOMSON and NICHOLSON, 1873; BENSON and SMITH, 1923; LEWIS, 1930; MENCHIKOFF and HSU, 1935; MINATO, 1943, 1955), and *L.* (*S.*) *pseudomartini* in the Upper Visean of Japan (YABE and HAYASAKA, 1915; MINATO, 1943, 1955).

Ozakiphyllum? sp. indet. resembles *Ozakiphyllum hayasakai*, *O. compactum* and *O. ozawae*. Very recently, *Ozakiphyllum hayasakai* was described by KATO and MINATO (1975) from the *Millerella* zone in the Edo area, Akiyoshi district. They thought that the zone showed early Namurian in age. *Ozakiphyllum compactum* was also described by KATO and MINATO (1975) from the Carboniferous at the Yakusen quarry, Isa, Akiyoshi. According to them, this coral also indicates early Namurian. OTA (personal communication) considers at present that the Carboniferous strata in question may belong to the *Nagatophyllum* zone. TORIYAMA and OTA (1971) considered the zone to be Middle Visean in age. *Ozakiphyllum ozawae* occurs in the Carboniferous limestons at the Uzura quarry, Akiyoshi (YAMAGIWA and OTA, 1963). Judging from the fusulinid data by OTA (1971), the Carboniferous belongs to the *Millerella* zone which is late Visean according to TORIYAMA and OTA (1971). From the same locality, the brachiopod fauna was described by YANAGIDA (1962, 1965), and the bryozoans by SAKAGAMI (1964). They assumed the age to be late Visean. On the other hand, IGO and KOIKE (1965) studied the conodont fauna collected from the same locality, and they think that it shows early Pennsylvanian or late Namurian in age. Very recently, KATO and MINATO (1975) considered that *Ozakiphyllum ozawae* may range from early Namurian to middle Pennsylvanian (*Fusulinella* zone) in age. The species of *Ozakiphyllum* in Akiyoshi occur in the *Nagatophyllum* zone (with some suspension) or the *Millerella* zone, but the decision of their age is in a state of disorder. According to the coral fauna, the distinct late Visean coral species from Japan, China and others such as the ones belonging to *Kueichouphyllum*, *Palaeosmilia*, *Dibunophyllum* and *Lithostrotion* (*Lithostrotion*) do not occur in the *Nagatophyllum* and *Millerella* zones in Akiyoshi up to the present. Moreover, the coral species from these zones (HASEGAWA, 1963; YAMAGIWA and OTA, 1963; TORIYAMA and OTA, 1971; KATO and MINATO, 1975) do not contain any corals clearly showing Visean age. Of them, some species have been reported from the Middle Carboniferous in other districts. The known data in Japan are as follows: *Hiroshimaphyllum* aff. *toriyamai* so closely related to *H. toriyamai* from the *Nagatophyllum* zone to the *Millerella* zone were discovered by GOTO and YAMAGIWA (1975) from the Hieda formation showing the *Fusulinella* zone in Hyogo Prefecture, *Amygdalophyllidium* cf. *naoseudeum* so closely allied to *A. naoseudeum* from the *Nagatophyllum* zone by YAMAGIWA (1961) from the *Profusulinella-Fusulinella* zone in Atetsu and by GOTO and YAMAGIWA (1975) from the Nishiobatake formation (Middle Carboniferous) in Hyogo Prefecture, and *Pseudopavona taisyakuana* from the *Millerella* zone to the *Fusulinella* zone by YOKOYAMA (1957) from the *Fusulinella* zone in Taisyaku and by YAMAGIWA (1961) from the *Profusulinella-Fusulinella* zone in Atetsu. Therefore, I consider that the *Nagatophyllum* zone and the *Millerella* zone in Akiyoshi indicate early Namurian age on the basis of the coral fauna.

From the above mentioned data, I suspect that: 1) *Ozakiphyllum* ? sp. indet. is similar to the species of *Ozakiphyllum* from the Lower Namurian in Akiyoshi. 2) *Lithostrotion* (*Siphonodendron*) *mitsuzawensis*, n. sp. is related to the species of *Lithostrotion* (*Siphonodendron*) from the Upper Visean in Japan, China and others. Therefore, the coral fauna from the Mitsuzawa limestone contains both types of late Visean and early Namurian in age. Of the above mentioned species showing the late Visean in age, *Lithostrotion* (*Siphonodendron*) *hidense*, however, probably extends to early Namurian. Moreover, many species belonging to *Lithostrotion* (*Siphonodendron*) occur in the Lower Carboniferous (Upper Visean) at many places in the world, but some in the Middle Carboniferous. On the other hand, the species of *Ozakiphyllum* have not been found in the late Visean up to the present, but in the early Namurian. Therefore, the present coral fauna may indicate early Namurian in age.

I wish to express my hearty thanks to Prof. Sumio SAKAGAMI of the Ehime University who permited me to study some interesting materials collected by him, and gave me kind advice to this study. My sincere thanks are extended to Prof. Emeritus Haruyoshi FUJIMOTO of the Tokyo University of Education for his reading the manuscript, and for his kind guidance. Thanks are also due to Dr. Masamichi OTA of the Akiyoshidai Science Museum for his kind guidance in the geological study of the Akiyoshi limestone. Photographic work was done by Mr. Fukumatsu SUGITA of the Osaka Kyoiku University, to whom I extend my many thanks.

Systematic description

Genus *Lithostrotion* LYWYD, 1699 (FLEMING, 1828)

Subgenus *Siphonodendron* M'COY, 1849

Lithostrotion (*Siphonodendron*) *mitsuzawensis*, n. sp.

Pl. 48, figs. 1-2

Corallum is fasciculate, composed of cyrindrical in form, usually 5.0 to 7.0 mm in diameter in transverse section in mature stage. External wall is relatively thin. Major septa are usually 14-18 in number, extending to the central area, but most of them do not unite with the columella. Minor septa are more or less variable in length, ranging usually from 1/3 to 2/3 the length of the major ones in mature stage; they are not seen in immature stage. Both major and minor septa are relatively thin and slightly sinuous; they show the fine structure of the diffuso-trabecular type. Columella is thin, slightly fusiform in shape, usually united with the counter and cardinal septa. Dissepiments are arranged concentrically, but sometimes irregular in pattern.

In longitudinal section, tabulae are incomplete, and rather steeply ascending to the columella. Columella is relatively distinct. Tabularium occupies 2/3 entire space of the corallites. Dissepimentarium is composed of small vesicles with their convex sides facing upwards as well as inwards; they are arranged in three rows.

Comparison: The present specimens much resemble *Lithostrotion* (*Siphonodendron*) *hidense* described by KATO (1959a) from the Ichinotani formation in the Hida massif in many important characters. The corallites of the latter, however, are arranged in somewhat linear pattern, and show round to polygonal outlines owing to their mode of contact to the neighbours. The present species is similar to *Lithostrotion* (*Siphonodendron*) *yaolingense* described by CHU (1928) from the Lower Carboniferous in China and *L.* (*S.*) *nakazawai* described by MINATO and KATO (1957) from a pebble in the conglomerate bed, a member of the Permian Maizuru Group, Southwest Japan in many respects, but differs from the latter two in having longer minor septa and less numerous septa. It is also related to *Lithostrotion* (*Siphonodendron*) *pauciradiale* described by PHILLIPS (1843), EDWARDS and HAIME (1852), KUNTH (1869), YÜ (1933), HILL (1940) and MINATO (1955) from the Lower Carboniferous, but differs from that in having small vesicles arranged in three rows in longitudinal section. It resembles *Lithostrotion* (*Siphonodendron*) *martini* described by EDWARDS and HAIME (1852), THOMSON and NICHOLSON (1875), BENSON and SMITH (1923), LEWIS (1930), MECHIKOFF and HSU (1935) and MINATO (1943, 1955), but is distinguishable from that in the inclination of tabulae and the size of corallites. It is also similar to *Lithostrotion* (*Siphonodendron*) *pseudomartini* described by YABE and HAYASAKA (1915) and MINATO (1943, 1955), but differs in having larger corallites and small vesicles arranged in three rows longitudinal section.

Occurrence: Limestone of Mitsuzawa in the southeastern part of the Kwanto massif.

Collector: Sumio SAKAGAMI.

Repository: Reg. no. PA11669 (holotype) (National Science Museum).

Genus *Ozakiphyllum* KATO and MINATO, 1975

Ozakiphyllum ? sp. indet.

Pl. 48, figs. 3-5

Corallum is compound and cerioid. Corallites are polygonal in shape, measuring usually 7.0 to 9.0 mm in diameter in transverse section in mature stage. Axial structure is so thickly constructed, oval in shape, and measures 1.7 to 2.5 mm in diameter; it consists of many septal lamellae, less numerous axial tabellae and a median plate. Septa are in two orders, alternating; they are almost straight, very thick at proximal ends and gradulaly thin distally. Naos-like structure is seen in peripheral part of several septa. Some septa disappear into meshes of lonsdaleoid vesicles in the peripheral area. Major septa are long and about 20 in number, but most of them do not connect with the axial structure. Minor septa are very long and slightly shorter than the major ones. There are no tertiary ones. Wall is very thick, and consists of lateral coalition of neighbouring septa. Dissepiments are arranged in concentric pattern.

In longitudinal section, dissepiments and clinotabulae are distinct. Transverse tabulae are also observed. Dissepimentarium occupies about 1/2 the width of a corallite. Axial tabellae and a median plate are so thickly constructed; the former show a dome-like structure.

Comparison: The present specimens much resemble the species of the genus *Ozakiphyllum* proposed by KATO and MINATO (1975) in many important characters, except the naos-like structure in peripheral part of several septa. Therefore, I place them in the genus *Ozakiphyllum* with some doubt at present.

The present species is very similar to *Ozakiphyllum compactum* described by KATO and MINATO (1975) from the lower part of the Akiyoshi limestone in many respects such as solid axial structure, thick septa, long minor septa, thick wall, weak developed lonsdaleoid vesicles and others, but differs from that in having thinner septa, less dense axial structure and several naos-like septa. It is closely related to *Ozakiphyllum hayasakai* KATO and MINATO (1975) from the lower part of the Akiyoshi limestone. However, the present form has larger corallites and several naos-like septa. Except for the naos-like septa, it may show an intermediate form between *Ozakiphyllum compactum* and *O. hayasakai*. It is sowewhat similar to *Ozakiphyllum ozawae* YAMAGIWA and OTA (1963) from the lower part of Akiyoshi. It, however, differs from that species by its larger corallites, more numerous septa and other respects.

Occurrence: Limestone of Mitsuzawa in the southeastern part of the Kwanto massif.

Collector: Sumio SAKAGAMI.

Repository: Reg. no. PA11670 (National Science Museum).

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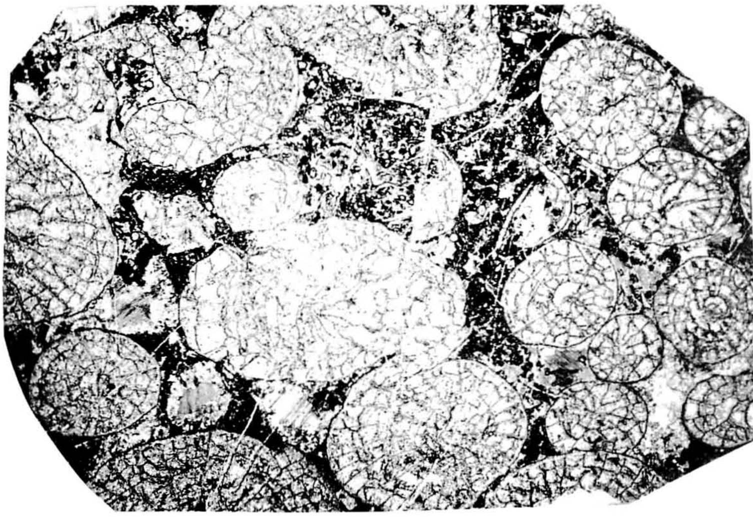
Explanation of Plate 48

Figs. 1-2. *Lithostrotion* (*Siphonodendron*) *mitsuzawensis*, n. sp.
1. Transverse section .... ×4.0 (PA11669a)
2. Longitudinal section .... ×4.0 (PA11669b)

Figs. 3-5. *Ozakiphyllum* ? sp. indet.
3. Transverse section .... ×4.4 (PA11670a)
4. Transverse section .... ×4.4 (PA11670b)
5. Longitudinal section .... ×4.4 (PA11670c)



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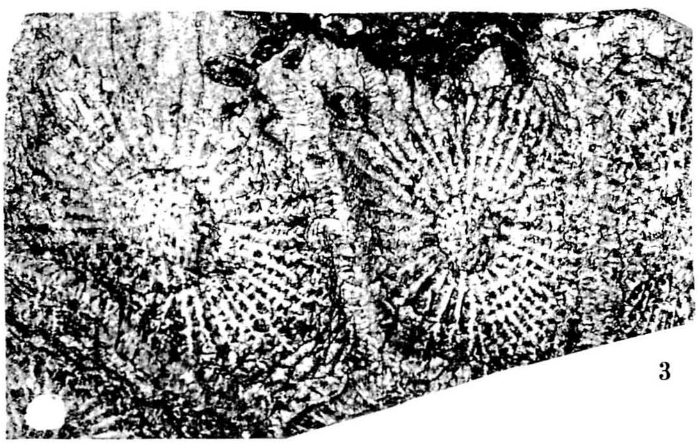

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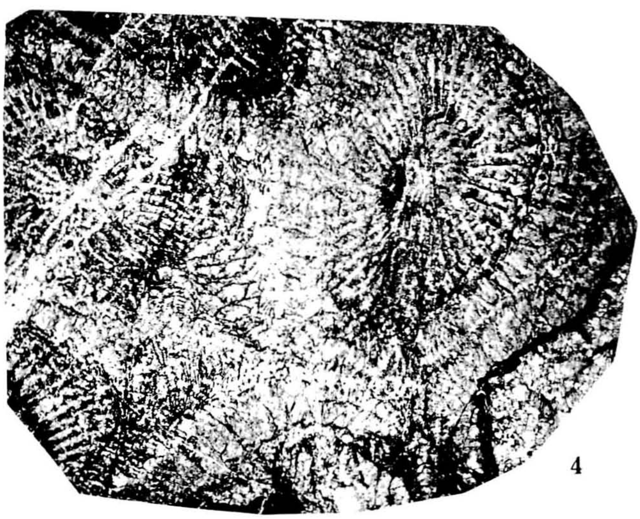

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Akiyoshi	秋　吉	Isa	伊　佐
Atetsu	阿　哲	Mitsuzawa	三ツ沢
Edo	絵　堂	Nishiobatake	西大畠
Hieda	稗　田	Taisyaku	帝　釈
Ichinotani	一ノ谷	Yakusen	薬　仙

Trans. Proc. Palaeont. Soc. Japan, N.S., No. 104, pp. 448-458, pl. 49, Jan. 20, 1977

671. LATE PLEISTOCENE *NIPPONICERVUS* (CERVID, MAMMAL) FROM THE AKIYOSHI PLATEAU, WEST JAPAN*

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山口県秋吉台産の後期更新世鹿科 *Nipponicervus* 亜属：山口県美東町の秋吉台北東部において最近発見された洞窟の堆積物から，若干の哺乳類化石とともに採集された鹿科化石（角つき頭骨）を研究した結果，それは *Cervus* 属の絶滅種族である *Nipponicervus* 亜属（=*Depéretia* SHIKAMA, 1936）の新種であることがわかった。この鹿の角の形態は明らかに *Nipponicervus* 亜属に特有のものであるが，一方，頭骨を構成する諸骨のうち涙骨と鼻骨に見い出されるいくつかの特徴は，この鹿が現棲種であるツシマジカ *Cervus* (*Sika*) *pulchellus* IMAIZUMI に近縁であることを示唆している。この新種鹿は *Nipponicervus* 亜属と *Sika* 亜属の系統発生の考察上，極めて重要である。包含層の時代は岩相・分布高度および共産した哺乳動物群からみて，更新世末から最新世初期にかけてのものであることが推定される。

大塚裕之

Introduction

In 1967, an almost complete skull of *Cervus* with attached right antler was collected by the staffs of the Akiyoshi-dai Science Museum of Akiyoshi-cho, Yamaguchi Prefecture from the deposits of Kadoyano-ana Cave, located at the northeastern part of the Akiyoshi plateau (=Akiyoshi-dai) of Yamaguchi Prefecture, West Japan. As the result of the succeeding excavation works, some well-preserved specimens of mammals were collected. These specimens were transferred to my laboratory for study through the kindness of Dr. Masamichi ŌTA of the Akiyoshi-dai Science Museum.

The deer in question holds very interesting morphological features of the antler and skull; of these, the antler shows that this deer is safely referable to the subgenus *Nipponicervus* (=*Depéretia*, SHIKAMA, 1936) and is closely related to the early Pleistocene fossil deer from Kyushu, West Japan. Slight relationships between the new species from Akiyoshi plateau and one living Japanese deer from the Tsushima Islands, can be recognized if we pay attention to a few characters of their skulls.

For these reasons, the present new species seems to be noticeable for the consideration on the phylogeny of the Japanese *Cervus* through the geological ages. Some remarks on this problem will be given in this paper.

Before going further, I wish to express my deep gratitude to Professor Shozo HAYASAKA of the Kagoshima University for his continuous encouragement and carefull reading of the manuscript, and to Dr. Masamichi OTA, Messrs. Akihiro SUGIMURA and Takehiko HAIKAWA of the Akiyoshi-dai Science Museum, Dr. Masa-

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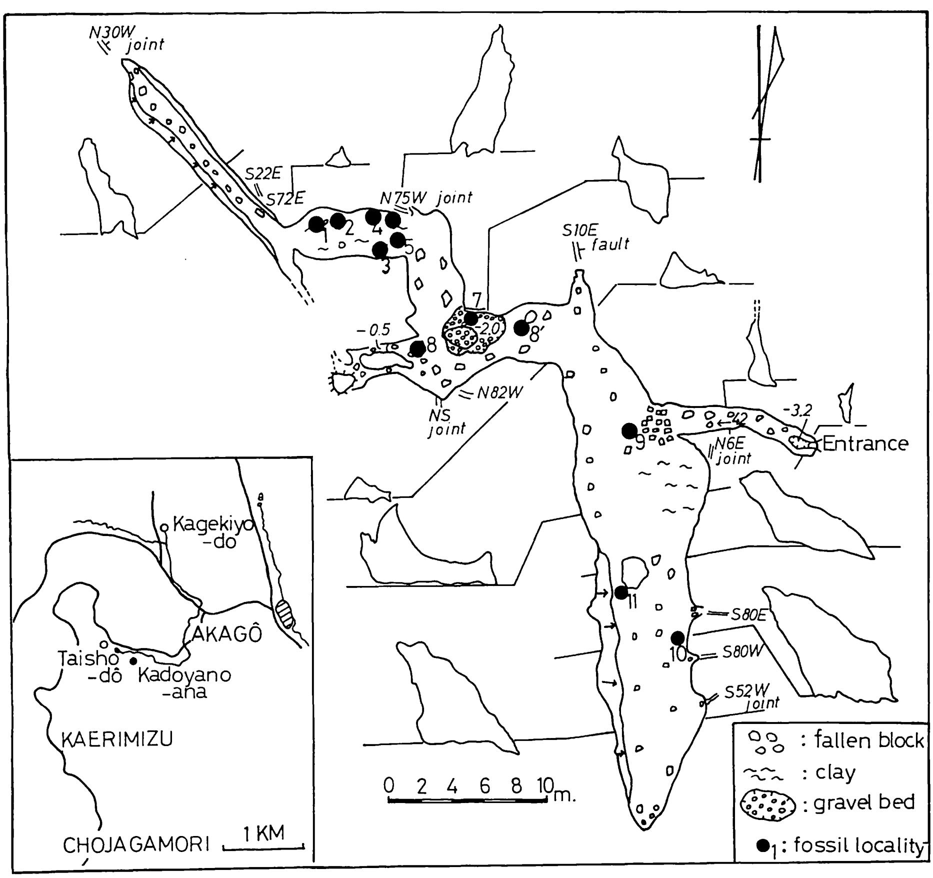
Fossil locality and stratigraphic position

The Kadoyano-ana Cave which was newly discovered by the members of the Caving Club of the Yamaguchi University is located at about 400 meters southwest of the entrance of Taisho-do Cave and opens northward on the northern slope of the plateau surface of the Akiyoshi plateau (Text-fig. 1). It is about 70 meters in length and eight meters in



Text-fig. 1. Plan and section of the cave called Kadoyano-ana (right) and the location (left).

maximum width; the entrance is very small, nearly half a meter wide and one meter high; from the small entrance the cave abruptly slopes down like a pit, and soon becomes to be connected with the main tunnel. The main tunnel, as a whole, is divided into three areas, i. e. the south, middle and north; at the south area it runs in north-south direction sloping from the south to the north, while at the north it extends from the northwest to the southeast sloping from the north to the south; at the middle area it trends in west-east direction and slightly sloping to the east. On the floor of the tunnel area accumlated thin layer of clay, gravel, and some fallen blocks of limestone.

The gravel bed is recognized in the middle, narrow area. It is more than two meters in thickness and composed of pebbles of limestone, sandstone and hard shale derived from Cretaceous Kanmon Group.

From this gravel bed, and from the floor of the tunnel, the following five mammalian species were collected.

Cervus (*Nipponicervus*) *akiyoshiensis*, n. sp.
Cervus (*Sika*) *nippon* TEMMINCK
Sus leucomytax TEMMINCK
Lepus brachyurus TEMMINCK
Rhinolophus sp.

Among these mammals, many skeletal parts of the last four species were collected from many places on the surface of the floor or from the thin layer of sandy sediments on the floor of the tunnel. They are slightly fossilized, light yellow in color and partly covered with a thin layer of calcareous sinter.

On the other hand, some remains of *C.* (*N.*) *akiyoshiensis*, n. sp. were excavaged from the gravel bed mentioned above. But the skull specimen described in this paper was found on the surface of the gravel bed in the middle area. This specimen, however, is more fossilized and of darker color than the other specimens collected from the floor. These features are characteristic of the specimens collected from the gravel bed. Therefore I believe that the skull specimen in question was washed out from the gravel bed.

Although there is no reliable evidence to date the geological age of the gravel bed of the Kadoyano-ana, the level and lithofacies of the gravel bed suggest that it can be correlated to the Akago gravel bed (MIURA, 1969) in the Akago basin near Kadoyano-ana Cave. The Akago gravel bed is the main constituent of the Upper Terrace in the basin and is covered with the Lower Terrace deposits called the Akago volcanic ash bed; it is correlated to the terrace deposits called the Shimoryo sandy clay bed (MIURA, 1969) which is distributed mainly in the western margin of the Akiyoshi plateau. The Shimoryo sandy clay bed, furthermore, is correlated to the Upper member of the Isa Formation (TAKAHASHI & KAWANO, 1968).

The Isa Formation was proposed by SHIKAMA & TAKAHASHI (1949) for the fissure deposits of the limestone quarries of Isa-machi, Miné City. At present the Isa Formation and its correlatives are divided into three, i. e. the lower, middle and upper members. The lower member, consists mainly of red clay and has yielded many extinct mammals such as *Stegodon orientalis* OWEN, *Panthera youngi* (PEI), *P.* cf. *pardus* (LINNAEUS) and others is called the *Stegodon-Panthera* bed (SHIKAMA & OKAFUJI, 1963). By means of the mammalian fauna, the lower member of the Isa Formation is correlated to the middle Pleistocene Lower Kuzuü Formation (SHIKAMA, 1949) of Central Japan and is considered to be the same age as the mammal-bearing deposits of Chukoutien near Peking in Chinese continent. The upper member consists mainly of gravelly clay and yielded such characteristic mammals as *Sinomegaceros* (*Sinomegaceroides*) *yabei* (SHIKAMA), *Cervus* (*Nipponicervus*) *praenipponicus* SHIKAMA, *Palaeoloxodon aomoriensis* TOKUNAGA, *Anourosorex japonicus* SHIKAMA & HASEGAWA and others, and is called *Anourosorex-Sinomegaceroides* bed (SHIKAMA & OKAFUJI, 1963). This bed is correlated to the late Pleistocene Upper Kuzuü Formation.

As mentioned above, the gravel bed that yielded *C.* (*N.*) *akiyoshiensis*, n. sp. seems to be correlated to the upper member of the Isa Formation from the geological point of view, but no mammalian fossils characterizing the upper member of the Isa Formation have been found in this gravel bed. Therefore, for their precise correlation further evidences are necessary.

The name Mukôyama bed was given to the sandy clay bed overlying the Akiyoshi brown clay bed at a quarry in Isa-machi, Miné City while the Chogatsubo bed was named for the shelly sandy clay bed at Kojiki-ana Cave (SHIKAMA & OKAFUJI, 1963). SHIKAMA & OKAFUJI (1963) considered that the Chogatsubo bed may represent a phase when a part of the Akiyoshi plateau was submerged. This Chogatsubo bed yielded several living species of mammals such as *Sus leucomytax* TEMMINCK, *Lepus brachyurus* TEMMINCK, *Mogera wogura* (TEMMINCK) and others, and is called the *Sus* bed. As to the age of these two beds, SHIKAMA and OKAFUJI considered them to be early Holocene ("K" stage in their paper). The mammalian fauna collected was found on the very thin, sandy layer on the floor of the Kadoyano-ana Cave, where no thick sediments as seen in the *Sus* bed existed. Therefore, I am of opinion that the age of the mammalian remains found on the floor

Table 1. Pleistocene stratigraphy in Akiyoshi district.
[After SHIKAMA & OKAFUJI (1963), TAKAHASHI & KAWANO (1968)]

Geological age		Stage \ Deposits	Fluvial	Fissure	Cave
Holocene		Yurakucho		Mukôyama F.	Chogatsubo F.
Pleistocene	Upper	Tachikawa			
	Upper		Akiyoshi brown clay Bed Akiyoshi volcanic ash Bed	Akiyoshi brown clay Bed (*Canis familiaris* Bed)	
	Upper	Shimosueyoshi	Shimoryo, Matsubara sand and clay Bed	Isa Formation — Upper: gravelly clay (*Anourosorex-Sinomegaceroides* Bed)	
	Middle	Tama Byobugaura	Kamisobara clay Bed	Isa Formation — Middle: sand and gravel, traverthine	
	Lower	Manchidani		Isa Formation — Lower: red clay (*Stegodon-Panthera* Bed)	

of the Kadoyano-ana Cave may be younger than those from the *Sus* bed.

Description

Order Artiodactyla

Family Cervidae GRAY, 1821

Genus *Cervus* LINNAEUS, 1758

Subgenus *Nipponicervus* KREZOI, 1941

Type-species: *Cervus praenipponicus* SHIKAMA, 1936

Remarks: *Depéretia* was established by SHIKAMA (1936) as a subgenus of the Pleistocene genus *Cervus* based on *Cervus praenipponicus* SHIKAMA from the late Pleistocene deposits of Central Japan. As was pointed by KREZOI (1941), however, the subgeneric name *Depéretia* has already been used for pectinid group by TEPPNER (1922) and for the antelope group by SHAUB (1923), therefore, the name *Depéretia* is invalid for the subgenus of deer from the nomenclatorial point of view. KREZOI (1941) proposed a new subgeneric name *Nipponicervus* for SHIKAMA's *Depéretia*.

In spite of KREZOI's comment, SHIKAMA's *Depéretia* has long been adopted by myself and some other Japanese paleontologists in this field without attention. But recently, I noticed about this mistake and accepted the subgeneric name *Nipponicervus* instead of *Depéretia* for *Cervus praenipponicus* and others (OTSUKA & SHIKAMA, 1976).

So long as the mode of the forking of the antler is concerned, *Cervus praenipponicus*, the type species of *Nipponicervus*, seems to be similar to the subgenus *Axis* (=Chital) of the southeastern Asia in having two-forking, wide angles of the first fork and inward branching of the terminal (second) fork. But many species of *Nipponicervus* including type species have higher point and narrower angles of the first forking than *Axis*. Such being the case, I regarded it an independent group from *Axis*.

Nowadays, six species of *Nipponicervus* have been described by SHIKAMA and me from the Pleistocene of Japan and China. Although, as a result of the study of abundant specimens of *Nipponicervus* from the late Pleistocene deposits in the Seto Inland Sea of West Japan, the following conclusion were obtained that some species recorded as "*Depéretia*" can be referable to the variation of *C.* (*N.*) *praenipponicus* or *C.* (*N.*) *kazusensis*. Consequently, two species of *Nipponicervus* were discriminated in the Pleistocene in Japan (OTSUKA & SHIKAMA, 1976).

The species of the subgenus *Nipponicervus* first appeared in early Pleistocene in East Asia and become distributed over Central to West Japan during middle and late Pleistocene ages. It was accompanied by *Stegodon* in early Pleistocene and by the *Palaeoloxodon-Sinomegaceroides* Complex (HASEGAWA, 1972) in middle and late Pleistocene. For these reasons, this deer is very important for the biostratigraphical, geochronological and palaeogeographical considerations of the Japanese Pleistocene.

Cervus (*Nipponicervus*)
akiyoshiensis, n. sp.

Pl. 49, figs. 1a-1d; Text-fig. 2, 1a-1b; 3, 1a-1c.

Material: A skull with a right antler attached. Reg. No. ESK 5062. (vide p. 458)

Locality: Kadoyano-ana Cave (vertical limestone cave) at Akago, Mito-cho, Mine-gun, Yamaguchi Prefecture.

Horizon: The gravel bed which yield the present new deer may be correlated to the Upper Isa Formation at the type area on the Akiyoshi Plateau; probably late Pleistone.

Specific diagnosis: The species has medium-sized and two-forked antler. Antler, supported on a rather short pedicle, is comparatively long, slender and moderately rugose. First tine is short and forked at a position high above burr, making small acute angles with beam. Hind (or outer) tine of terminal fork is somewhat longer than front (or inner) ones, forming the continuation of beam. From front or front-inner surface of terminal fork, front tine arises as an off-shoot. Beam above first fork is about four and half times as long as the beam below first fork. Antler is less expanded outward than in the type species of *Nipponicervus* and a space enclosed by the antler of opposite sides is more or less of elliptical form.

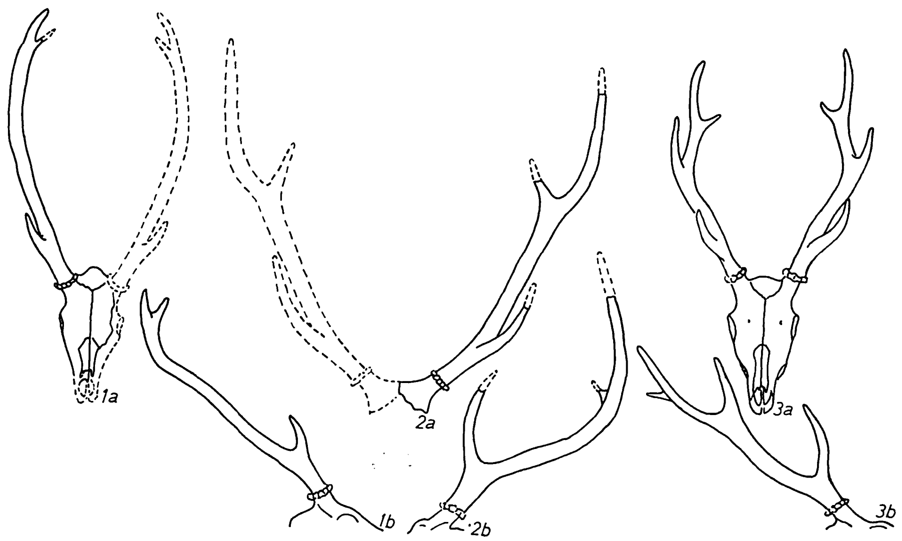
Nasal bone is very short but broad and forms a nearly trapezoidal outline in section. Malar bone is very narrow but moderately long and is much constricted near the antero-lower side of orbital ring.

Description of the specimen: Antler. The antler, supported on rather short pedicle on the skull, is very slender, long, irregularly curved and measuring 435mm from the burr to the tip of the inner (or hind) tine of the terminal fork. The burr is moderately thick, rugose, circular and 47.0×44.1 mm in diameter. In lateral view, the beam streches backward from the base without any peculiar curvature, then upward near the terminal fork. In frontal view, the antler is somewhat expanded outward and a space enclosed by the antlers of opposite sides is more or less elongated elliptical-shaped, if restored. The first tine is very short, small and forked at a position rather high (about 58 mm) above the burr, making an angle of about 45 degrees with the beam. It is projected forward, somewhat outward. The height of the first fork is nearly equal to the other species of *Nipponicervus* but is higher than the living Japanese deer. The interval between the first and the second forks is long, being 388 mm when measured in a straight line. It is nearly four and a half times as long as the beam between the burr and the first fork. This value is somewhat larger than the other species of *Nipponicervus* and much larger than the living Japanese deer. The hind (or outer) tine of the terminal fork is somewhat longer than the front (or inner) one, forming the continuation of the beam. From the front or the front-inner surface of the terminal fork, the front tine arises as an off shoot.

The measurements of the antler in mm or degrees are as follows:

Diameter of burr	fore-and-aft 47.0; side-to-side 44.1
Thickness of burr	6.8–8.0
Diameter of beam at middle	fore-and-aft 22.1; side-to-side 21.0
Height of first fork	58.0
Length of first tine	70.0
Length of beam from burr to second fork	399
Distance between first and second forks	388
Angle of first fork	45

Skull. The skull of the present specimen seems to be the best one in the mode of preservation compared with the many other specimens of *Nipponicervus* which have been reported from the Japanese Islands. But some small bones that constitute the skull of the present specimen such as the maxilla, the premaxilla and others are missing.



Text-fig. 2. Skull with antler of the living and fossil species of *Cervus*. Frontal (a) and lateral (b) views. 1. *Cervus (Nipponicervus) akiyoshiensis* n. sp., 2. *Cervus (Nipponicervus) praenipponicus* SHIKAMA from Kuzuü Formation (holotype), 3. *Cervus (Sika) pulchellus* IMAIZUMI from Tsushima Islands (holotype).

The skull is about 233mm in preserved length. It is almost equal to the length from the occipital condylus to the anterior end of the maxilla. The present skull specimen has the following three characteristic osteological features.

One of them is the nasal bone. It is broad and forms a nearly trapezoidal outline in transverse section (Text-fig. 4, fig. 1c). The anterior end of the nasal bone is broad and divided into two parts by a rather deep notch, in which the outer side is much prolonged anteriorly but does not reach the anterior margin of the palatine fissure.

The second character is the feature of the malar bone. The bone is very narrow, moderately long and convex ventrally at the front of the orbital ring between the lacrimal and the maxilla bones, and is much constricted near the antero-ventral margin of the orbital ring. The zygomatic process divides into two branches; of these, the frontal branch is very short but broad and turns upward and somewhat backward and joins the long supraorbital process of the frontal bone; the terminal branch is broad and is overlapped by the zygomatic process of the terminal bone.

In the present specimen, the supraorbital process of the frontal bone stands almost vertically on the nearly horizontal zygomatic arch (the zygomatic process of the malar and the temporal bones), while in the other living Japanese deer, the former process declines backward making large acute angles with the zygomatic arch.

Other osteological features of the skull of the present species do not differ much from the living Japanese deer.

Measurements of teeth and the skull are as follows (in *mm*).

(Teeth)

	Width	Length
PM1	11.2	11.5
PM2	13.7	11.5
PM3	13.6	10.3
M1	15.8	13.4
M2	17.0	17.0
M3	17.0	17.4

Teeth row (PM1-M3) 77.5

(Skull)

Preserved length of skull (length from occipital condylus to the anterior end of maxilla)........................223.3
Maximum width of nasal bone 34.7
Maximum length of nasal bone 79.4
Maximum width of frontal bone between orbital rings of opposite side 82.0
Distance between both orbital foramens 52.5
Diameter of orbital ring ....24.4×25.5

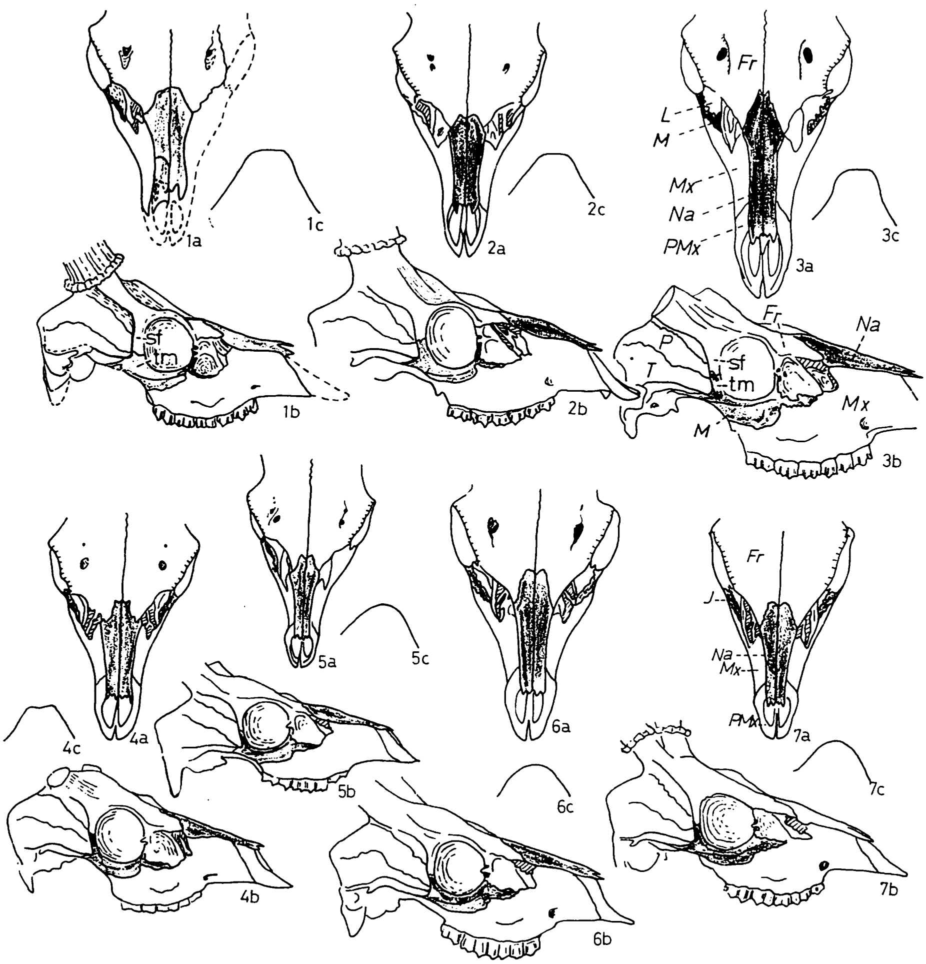
Comparisons and observations: Antler. As was mentioned by SHIKAMA (1936, 1941, 1949), the antler of the subgenus *Nipponicervus* is characterized by two-forked antler in the full-grown stage with a high position of the first forking; the outer tine of the terminal fork (second fork) is longer than the inner one, forming a continuation of the beam. So long as the mode of the forking is concerned, the subgenus *Nipponicervus* is closely related to Chital (subgenus *Axis*) but is certainly distinguishable from the latter by high position of the first forking. It is also differs from the living Japanese deer (subgenus *Sika*) in the mode of forking. That is to say, the antler of the living Japanese deer have three- or four-forked antlers in full-grown male and the distance between the first and the second fork rather short and the second tine arises from the front or front-outer surface of the second forking.

The new species from Akiyoshi plateau has slender antler with high position of the first forking, long distance between the first and the second forking and the second tine arises from the front-inner surface of the second forking. Based upon those characters, the new specimen from Akiyoshi plateau is safely referable to the subgenus *Nipponicervus.*

If we compare the type specimen of the antler of the present new species with that of the type and the ideotype specimens of *C.* (*N.*) *praenipponicus* SHIKAMA, the following differences and similarlities are noticed. 1) In general, the antler of *C.* (*N.*) *praenipponicus* expands outward and a space enclosed by the antler of opposite sides is more or less V-shaped in frontal view, but in *C.* (*N.*) *akiyoshiensis*, it forms an elliptical form, 2) The height of the first fork of *C.* (*N.*) *akiyoshiensis* is within the extent of variation of *C.* (*N.*) *praenipponicus*, but the antler of the first fork is larger in the former than in the latter, 3) In *C.* (*N.*) *akiyoshiensis*, the beam stretches from the base without any peculiar curvature, and 4) *C.* (*N.*) *akiyoshiensis*, furthermore, differs from *C.* (*N.*) *praenipponicus* in having rather rugose and small first tine.

Recently IMAIZUMI (1970) gave a description of a very interesting deer from the Tsushima Islands, under the name of *C.* (*Sika*) *pulchellus* IMAIZUMI, based on two male and one female specimen. The features of the antler of *C.* (*N.*) *akiyoshiensis* somewhat resembles but differs from *C.* (*S.*) *pulchellus* in the following charcters. In *C.* (*S.*) *pulchellus*, the adult male has a three-forked antler and their beam above the first forking much lyrated backward as seen in many other Japanese deer, but *C.* (*N.*) *akiyoshiensis* has a nearly straight, two-forked, antler. Other species referable to subgenus *Sika* in Northeast Asia are distinguishable from the present species in the same respects.

C. (*Rusa*) *kyushuensis* OTSUKA from the upper part of the Ōya Formation of the



Text-fig. 3. Skulls of different species of the genus *Cervus* from the Japanese Islands. Frontal (a) and lateral (b) views and the transverse outline of their maxilla and nasal bones (c). 1. *Cervus* (*Nipponicervus*) *akiyoshiensis* OTSUKA n. sp. from the Akiyoshi plateau, 2, *C.* (*Sika*) *pulchellus* from the Tsushima Islands (NSM13693), 3. *C.* (*Sika*) *nippon yezoensis* from Hokkaido (NSM4981), 4. *C.* (*Sika*) *nippon nippon* from Kyushu (NSM2769), 5. *C.* (*Sika*) *nippon yakushimae* from Yaku-shima, Kyushu (NSM2801), 6. *C.* (*Sika*) *nippon centralis* from Minamishinano-mura, Shimo-ina-gun, Nagano Prefecture (NSM16145), 7. *C.* (*Sika*) *nippon centralis* from same locality as NSM14145 (NSM16144). [Na: nasal bone, L: lacrimal bone, PMx: premaxilla, Mx: maxilla, Fr: frontal bone, Ma: malar bone, T: squamous temporal bone, P: parietal bone, zt: zygomatic process of temporal bone, zm: zygomatic process of malar bone, tm: temporal process of malar bone, st: supra orbital process of temporal bone]

Kuchinotsu Group (early Pleistocene; middle- to upper Villafranchian) (OTSUKA, 1968) shows a little alliance to the present new species in the general form of the antler but is distinguishable from the present new species in having a strong first tine and a lower position of the first forking.

Skull. As far as the feature of the malar bone of the skull is concerned, the type specimen of the present new species more resembles *C.* (*S.*) *pulchellus* than *C.* (*N.*) *praenipponicus* and other living Japanese deer, in having a very narrow, very delicate construction and in having a much constricted part near the front of the orbital ring (Text-fig. 3, figs. 3 and 5-7).

The skull of young female specimen of *Cervus* was reported from the Upper Kuzuü Formation (Upper Pleistocene) under the name of *C.* (*N.*) *praenipponicus* SHIKAMA (SHIKAMA, 1946, Pl. 9, fig. 1, Reg. No. 61644). As long as this specimen is concerned, the skull of *C.* (*N.*) *praenipponicus* SHIKAMA has broad, less constricted malar bone and its feature more resembles *C.* (*S.*) *nippon centralis* KISHIDA than the present new species.

The frontal aspect of the nasal bone of the present new species differs much from other living Japanese deer but is somewhat allied to *C.* (*S.*) *pulchellus* in having broad, less prolonged form with a rather deep notch at the anterior end. Furthermore, rather squarish outline of the nasal bone of the present new species suggests the existence of slight alliance with *C.* (*S.*) *pulchellus* or *C.* (*S.*) *nippon nippon*.

Concluding remarks: On the basis of the foregoing descriptions and considerations, the following statements are made as a conclusion.

C. (*N.*) *akiyoshiensis*, the final or advanced species of the subgenus *Nipponicervus*, may be closely related to *C.* (*S.*) *pulchellus* by blood and the latter species may have been derived from *C.* (*S.*) *nippon* TEMMINCK as a result of cross breeding between *C.* (*S.*) *nippon* and *C.* (*N.*) *akiyoshiensis*. The age of these cross breeding may be latest Pleistocene or early Holocene.

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Pub. Comm. Prof. Yabe's 60th Birthday, vol. 2, p. 1125-1170, pl. 52.
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Akago	赤 郷	Kuchinotsu	口ノ津
Chukoutien	周口店	Kuzuü	葛 生
Chogatsubo	長ケ坪	Miné	美 禰
Isa	伊 佐	Mukoyama	向 山
Kadoyano-ana	角谷ノ穴	Ôya	大 屋
Kanmon	関 門	Shimoryo	下 領
Kojiki-ana	乞食穴	Taishodo	大正洞

ESK: Abbrevation for the Institute of Earth Sciences, Faculty of Science, Kagoshima Uuiversity.

Explanation of Plate 49

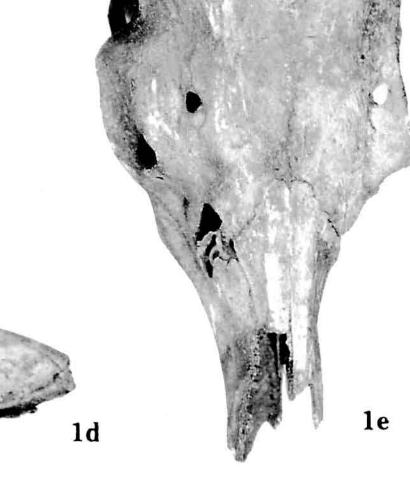
Fig. 1. *Cervus* (*Nipponicervus*) *akiyoshiensis* OTSUKA, n. sp. ......p. 452.
Frontal (a, e), lateral (d, c) and occulsal (b) views [Fig. 1a (×0.25), Figs. 1b and 1d (×0.45), Fig. 1c (×0.3) and Fig. 1e (×0.45)].

1b

1c

1a

1d



1e

PROCEEDINGS OF THE PALAEONTOLOGICAL SOCIETY OF JAPAN

日本古生物学会第118回例会は，1976年10月4日（月）に北海道大学理学部において開催された（参会者16名）．

個人講演

1. 底棲有孔虫化石による男鹿半島と関東地方の新第三系の対比 ....栗原謙二
2. Capulid borings in *Cryptopecten vesiculosus* from the Moeshima shell bed.... .... A. MATSUKUMA
3. On some interesting bivalves from the Cretaceous Himenoura Group in Kyushu ....M. TASHIRO (代読)
4. Further notes on the Vascoceratids from Hokkaido..........T. MATSUMOTO
5. Continuation of Cyanophyceae and other algae in limestone from the Kitakami Mountain Range............C. OKAMURA
6. 天北上部新第三系産羽状目珪藻2新属，*Onitsukaia* 他....................小村精一
7. 山形県新庄盆地の鮮新世植物群につい .... 植村和彦
8. 瑞浪層群中村層産水蓮科化石について .... 尾崎公彦
9. 京都府丹後地域の中新世植物群について .. .. 尾上 亨
10. On the *Nyssa* leaves from the Miocene Kobe Group, Western Honshu, Japan.. .... T. TANAI
11. 微細脈による *Liquidambar* 属化石葉の再検討 ....棚井敏雅

SYSTEMATIC INDEX

(New Series No. 97—No. 104, excluding No. 100 Supplement)

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Arthropoda

Conodontochordata

Vertebrata

PALAEOBOTANY

(Megafossils)

(Microfossils)

MISCELLANEA

INDEX OF FAMILIES, GENERA AND SPECIES

Notes: Words listed are names of families, genera and species, which are either described or illustrated in the articles in Transactions and Proceedings of the Palaeontological Society of Japan, New Series, Nos. 97-104 excluding No. 100 supplement; words in heavy type are names of new genera and species and other new taxa proposed.

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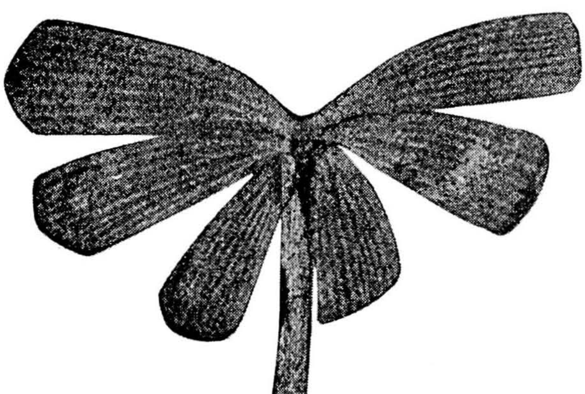

日 本 古 生 物 学 会

Palaeontological Society of Japan
Jan. 20, 1977

The heading in Japanese commemorates the handwriting of Prof. Matajiro YOKOYAMA, father of Japanese palaeontology, who was a professor of stratigraphy and palaeontology at the Geological Institute, Imperial University of Tokyo.

Fossil on the cover is the six leaves in a whorl of *Trizygia oblongifolia* (GERM. & KAULF.) ASAMA from the Maiya Formation (*Parafusulina* zone), Maiya, N. E. Japan.

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Number 102 (Published July 15, 1976)

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Number 103 (Published October 15, 1976)

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Engl. edit. FUSUJIMA, R.

The Second ISSOL Meeting and the Fifth International Conference on the Origin of Life, Kyoto, April 5-10, 1977

上記国際学会が京都国際会館で開催される。すでに Second Circular まで発行されているが，申込みおよび各種問合せは下記で受付けている。

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電話 (06) 851-1151 代

日本学術会議第 11 期会員選挙について

昭和 52 年 11 月 25 日投票締切りで上記選挙が行なわれる。会員を選挙し会員に選挙されるためには日本学術会議の有権者名簿に登録されている必要がある。前回（第 10 期）の選挙において有権者であったものは，通知がない限りあらためて登録する必要はない。ただし，氏名，住所（住居表示の変更を含む），勤務機関，勤務地，身分等のいずれかに異動があった場合には「有権者異動届」（様式第 3）を，また専門分野に変更があった場合には「所属部又は専門変更届」（様式第 2）を提出しなければならない。前回の有権者以外の者で有権者名簿に登録を希望する者は「登録用カード用紙請求書」（様式第 1）によりカードを入手し，昭和 52 年 3 月 31 日までに選挙管理会にそれを提出しなければならない。

上記各書類については次頁を参照されたい。

なお，選挙に関する問い合せ等は下記で受付けている。

日本学術会議 中央選挙管理会
〒106 東京都港区六本木 7-22-34
電話 (03) 403-6291

（以上は日本学術会議中央選挙管理会委員長から学会長宛の要請により，選挙説明書から要約して掲載した。）

様式第 1（B5判）

登録用カード用紙請求書

（ふりがな）
氏　　名　　　　　　　　　　　　　　　　　　　　　　　印
住　　所（郵便番号）

様式第 2（B5判）

所属部又は専門変更届

昭和　　年　　月　　日

日本学術会議中央選挙管理会　御　中

（現登録の所属）第　　部　　学　　地方区
（ふりがな）
氏　　名　　　　　　　　　　印

私は、現在の専門を変更いたしたいので登録用カード用紙を請求いたします。

様式第 3（B5判）

有権者異動届

日本学術会議中央選挙管理会　御中　　　　昭和　　年　　月　　日

第　　部　　学　　地方区
（ふりがな）
氏　　名　　　　　　　　　　印

下記のとおり異動がありましたからお届けします。

事　　項	（新）	（旧）
1　氏　　名		
2　住　所（郵便番号）		
3　本　　籍		
4　勤務機関及び職名		
5　勤務地（郵便番号）		
6　博士の学位	① 学位の種類　② 授与大学 ③ 授与年　昭和　　年　④ 所属学会	

（注）　新たに博士の学位を取得した者は、学位の種類、授与大学、授与年とともに必ず所属学会名を記入すること。

備考　　様式第1、第2、第3とも、用紙は「はがき」を用いても差し支えありません。

日本古生物学会会員名簿

(1976年11月30日現在)

日　本　古　生　物　学　会

〒113　東京都文京区弥生2-4-16

学会センタービル内

凡　　　例

1. 名簿には1976年11月30日現在の各会員の氏名，入会年，勤務先，現住所，および専攻を記してある。
2. 氏名はアルファベット順に記し，氏名の前の＊は特別会員を示す。
3. 勤務先および専攻は誤解を生じない範囲で簡略化してある。
4. 現住所は原則として自宅住所を記入した。

———◇———◇———◇———

名簿の誤記・誤植，または住所などに変更があった際は，至急学会までお知らせ下さい。

———◇———◇———◇———

会員総数	529
名誉会員	6
賛助会員	10
特別会員	148
普通会員	309
在外会員	56

賛　助　会　員

会　社　名	住　所	
出光日本海石油開発株式会社	100	東京都千代田区丸の内3-1-1
インドネシア石油資源開発株式会社	105	東京都港区芝西久保明舟町16　第15森ビル
イラン石油株式会社	100	東京都千代田区永田町2-4
関東天然瓦斯株式会社	103	東京都中央区日本橋室町2-1-1　三井ビル
三菱石油開発株式会社	100	東京都千代田区大手町2-6-2　日本ビル
瑞穂建材工業株式会社	198	東京都青梅市成木8-877
SG技研株式会社	862	熊本市健軍町4504　チヨダビル
石油開発公団石油開発技術センター	105	東京都港区芝西久保明舟町20　第18森ビル
石油資源開発株式会社	100	東京都千代田区大手町1-6-1　大手町ビル
帝国石油株式会社	151	東京都渋谷区幡ケ谷1-31-10

名　誉　会　員

氏　名	入会年	勤務先	現　住　所		専　攻
藤本治義	1935	秩父自然科学博	165	東京都中野区江原町1-32-8	生層位，有孔虫，サンゴ
半沢正四郎	35	東北薬科大	982	仙台市遠見塚2-34-16	有孔虫
早坂一郎	39		194	東京都町田市大蔵町2228	古生代無脊椎動物
小林貞一	35		151	東京都渋谷区代々木5-50-18	三葉虫，オウム貝類等
今野円蔵	35		999-37	山形県東根市柳町9266	古，中生代植物
槇山次郎	35		606	京都市左京区田中春草町22	生層位，軟体動物

会　　員

氏　名	入会年	勤務先	現　住　所		専　攻
				〔A〕	
赤木三郎	1954	鳥取大教育地学	680	鳥取市湖山町2960-77 白浜宿舎RC1-203	第四紀地質
秋葉文雄	69	石油資源開発(株)技研	359	埼玉県所沢市緑町4-43-23 石開眺遠寮	珪藻生層位
*阿久津純	48	宇都宮大教養地学	329-27	栃木県那須郡西那須野朝日町8-1	珪藻
*天野昌久	51	熊本大理地学	862	熊本市保田窪本町出山739	生層位，二枚貝
安藤保二	63	神戸西高	673	兵庫県明石市太寺4-15-9	軟体動物
青木直昭	58	東教大理地鉱	174	東京都板橋区前野町6-24-5-607	有孔虫，生層位
青島睦治	72	三洋水路測量(株)	174	東京都板橋区西台1-36-15 やよい荘	
青山尚友	71	都城ろう学校	885	宮崎県都城市郡原町7985 教職員住宅第K号	古生態，生痕化石
*新井重三	52	埼玉大教育地学	338	埼玉県与野市大戸1079-3	堆積
荒木慶雄	50	三重大教育地学	514	三重県津市八町2-6-22	層位，軟体動物
荒木英夫	76	気仙沼市図書館	988	宮城県気仙沼市太田2-6-105	三葉虫，ペルム紀腕足類・頭足類
有川隆一	73	東北大理地質古生物	982	仙台市長町字長岬25-3 昭栄アパート	微古生物
浅賀正義	74	佐倉高	281	千葉市花見川7-14-502	軟体動物

*浅間 一男	1940	国立科学博	168	東京都杉並区永福1-5-8	古植物
浅見 清秀	68		230	横浜市鶴見区東寺尾445	
*浅野 清	35		983	仙台市木ノ下41-109	化石層位，古環境，有孔虫
				〔B〕	
*坂東 祐司	56	香川大教育地学	760	高松市花園町3-4-6 花園住宅254	生層位，頭足類
				〔C〕	
*千地 万造	58	大阪市立自然史博	596	大阪府岸和田市並松町10-2	生層位，有孔虫
*鎮西 清高	56	東大理地質	227	横浜市緑区市ケ尾町 市ケ尾プラザビル701	軟体動物，古生態：生層位
千坂 武志	48	千葉大教育地学	167	東京都杉並区下井草3-33-16	紡錘虫
崔 東龍	70	国際航業(株)	356	埼玉県川越市砂85	層位，古生物
				〔E〕	
*江口 元起	36	東京家政大	188	東京都保谷市泉町4-7-11	腔腸動物
江藤 哲人	69	横浜国大教育地学	232	横浜市南区庚台76	小型有孔虫
衛藤 俊治	48	岐阜大教養地学	501-31	岐阜市芥見字間無田6305-125	層序，写真地質
				〔F〕	
深田 淳夫	51	(株)応用地質調査事務所	184	東京都小金井市本町1-15-15	アンモナイト
福田 芳生	68	福田古生物研	284	千葉県印旛郡四街道町1585	甲殻類，古生態
*福田 理	48	地調燃料部	360	埼玉県熊谷市本町2-78	
*藤 則雄	61	金沢大教育地学	921	金沢市窪4-206	花粉
*藤井 昭二	55	富山大教養地学	930	富山市安養坊161-2	新生代軟体動物
藤島 泰隆	74	北炭地質調査所	068-04	北海道夕張市鹿の谷山手町28	軟体動物
藤田 郁男	60	砂川北高	073-01	北海道砂川市西4条北5丁目	新生代巻貝，生痕，層位
*藤山 家徳	65	国立科学博	121	東京都足立区花畑町 花畑団地32号棟401	古昆虫
古川 隆治	69	ナイジェリア石油開発(株)	158	東京都世田谷区深沢5-12-1 玉川アパート	地質，古生物
				〔G〕	
後藤 博弥	65	神戸大教養地学	679-41	兵庫県竜野市竜野町堂本380-4	紡錘虫，層位
後藤 仁敏	67	鶴見大歯解剖	114	東京都北区中里3-16-10-401	脊椎動物
				〔H〕	
*波部 忠重	51	国立科学博	182	東京都狛江市和泉3146-17	軟体動物
波田 重熙	65	高知大文理地質	780	高知市朝倉甲481-1	構造地質
配川 武彦	72	秋吉台科学博	754	山口県美祢郡秋芳町嘉万1922	フズリナ，サンゴ
浜田 潤一	64	新塩屋町小	761-42	香川県小豆郡土庄町伊喜末1823-3	古生界層位，三葉虫
*浜田 隆士	55	東大教養宇宙地球科学	167	東京都杉並区天沼2-20-2	サンゴ類，腕足類，三葉虫類
*花井 哲郎	48	東大理地質	152	東京都目黒区八雲5-18-24	貝形類
原 卓郎	62		759-13	山口県阿武郡阿東町生雲	哺乳動物
原田 憲一	75	京大理地鉱	606	京都市左京区吉田中大路町6，森方	渦ベン毛虫類
針生 真也	74		221	横浜市神奈川区二谷29	微古生物
*長谷 晃	50	広島大理地鉱	738	広島県佐伯郡二日市町佐方月見台615-49	層位
長谷川 淳一	74	東大農	350-02	埼玉県坂戸市末広町9-18	

長谷川 四郎	1973	東北大理地質古生物	982	仙台市古城2-1-43	生層序
長谷川 康雄	67	県立高田盲学校	943	新潟県上越市東本町5-3-44	珪藻
*長谷川 善和	56	国立科学博	249	神奈川県逗子市沼間3-16-15	脊椎動物
*長谷川 美行	61	新潟大教養地学	951	新潟市西大畑町5214 新潟大宿舎RA502号	紡錘虫
長谷 弘太郎	65	(株)長谷地質調査事務所	980	仙台市本町3-5-8，同左	地質
長谷 義隆	75	熊本大理地学	862	熊本市水源1-16-12	層位
*橋本 勇	53	九大教養地学	815	福岡市南区長住6-10-29	層位
橋本 恭一	67	八坂中学校	747	山口県防府市古祖原2-2	フズリナ，サンゴ
*橋本 亘	50	千葉大理地学	177	東京都練馬区東大泉町918	層位，層孔虫，大型有孔虫
*波多江 信広	35	(株)応用地質調査事務所	818-01	福岡県筑紫郡太宰府町醍醐	軟体動物
*畑井 小虎	35	東北大理地質古生物	983	仙台市旭ヶ丘2-14-21	地史，腕足類，軟体動物，生痕
*速水 格	54	東大総合研究資料館	166	東京都杉並区成田東1-40-29	二枚貝，進化生物学
速水 倶子	69	愛媛大教育地学	790	松山市木屋町3-8-4 しらさぎマンション303	第三紀コケ虫類
*早坂 祥三	54	鹿児島大理地学	892	鹿児島市吉野町11119-3	新生代軟体動物
林 明	76	東京学芸大	332	埼玉県川口市本町1-1-9	新生代有孔虫，層位
林 信悟	58	大間々高	376-01	群馬県山田郡大間々町1-1227	コノドント
林 唯一	51	愛知教育大地学	489	愛知県瀬戸市萩山台24-4	第三紀軟体動物
林 徳衛	69		811-52	長崎県壱岐島石田町1091	層位，古生物（魚，植物）
樋口 雄	51	アンデス石油開発(株)	105	東京都港区芝西久保明舟町16 第15森ビル，同左	石油地質，有孔虫
平野 弘道	65	九大理地質	814	福岡市西区高取2-15-19，新地荘	進化，分類
平田 茂留	69		780	高知市愛宕山17	
*平山 勝美	48	立教大一般教育地学	165	東京都中野区江原町1-33-10	新生代軟体動物
久光 正雄	69	盛岡第一高	029-43	岩手県胆沢郡衣川村富田	紡錘虫
日高 稔	62	大分上野丘高	870-03	大分市大字細170	第四系層序
北条 凱生	63	戸畑高	806	北九州市八幡区若葉1丁目 市住115	第三紀植物
本田 博巳	74	石油資源開発(株)技研	192-02	東京都多摩市一の宮947-18	古生態
本田 裕	73	東北大理地質古生物	980	仙台市原町小田原土手前1 東北大松風寮	軟体動物
堀口 万吉	58	埼玉大教養地学	338	浦和市上木崎519	石灰藻
堀口 敏秋	73	秩父セメント(株)	238	神奈川県横須賀市吉倉町1-5	古生物
*堀越 増興	48	東大海洋研	135	東京都江東区越中島1-3 越中島住宅17-1011	軟体動物，海棲底生群集生態
*藤岡 一男	38	秋田大鉱山鉱山地質	010	秋田市新藤田字三十刈1-105	古植物

〔I〕

茨木 雅子	72	静岡大理地球科学	421-01	静岡市丸子新田390	有孔虫
*市川 浩一郎	48	大阪市大理地学	593	大阪府堺市堀上緑町2-10-9	中生代軟体動物，放散虫
*市川 渡	35		920	金沢市石引町2-28-12	珪藻，珪質べん毛虫類
市倉 賢樹	73	横浜市立上白根中	241	横浜市旭区東希望ヶ丘39 岡田方	
猪郷 久治	70	東京学芸大地学	177	東京都練馬区高野台1-13-6	コノドント，紡錘虫

*猪郷久義	1954	筑波大地球科学	190	東京都立川市栄町1-31-7	コノドント，紡錘虫，サンゴ
*池辺展生	35	大阪市大理地学	659	兵庫県芦屋市浜町6-4	生層位
池田　正	74	奈良教育大地学	633-02	奈良県宇陀郡榛原町下井足1415	有孔虫
*池谷仙之	62	静岡大理地球科学	422	静岡市大谷836	有孔虫
生路幸生	74	石油資源開発(株)札幌鉱業所	062-21	札幌市南区川沿3-3-1610 石開川沿寮	有孔虫
*今泉力蔵	36	東北大教養地学	982	仙台市八木山香澄町15-12	中生代藻類・甲殻類
*今村外治	35		733	広島市高須4-163-10	層位
今村忠彦	55	安芸高	781-02	高知市瀬戸西町3-138	地学教材の研究
*今西　茂	48	熊本大教養地学	862	熊本市画図町下江津1040-2-23	生層位
伊奈治行	75		479	愛知県常滑市山方120	古植物
稲田卓史	73	大阪市大大学院	558	大阪市住吉区山之内町1-118 岡本荘10号	第四紀地質
猪間明俊	61	石油資源開発(株)	188	東京都田無市芝久保2-13 石油開発アパート112	石油地質
井上英二	72	地調海洋地質部	281	千葉市園生町1113-4 ドルミ稲毛213	海洋地質，石炭地質
井上雅夫	74	岩手大教育	020	盛岡市上田3-18-33 同左	堆積
井上　武	39	秋田大鉱山	010	秋田市手形字中台59-14	層位
井上洋子	76	石油資源開発(株)技研	168	東京都杉並区浜田山4-6-6	生層位，有孔虫
石橋　毅	67	九大理地質	811-31	福岡県粕屋郡古賀町久保 古賀公務員宿舎7-32	中生代頭足類
石田正夫	58	地調北海道支所	060	札幌市南1条西18丁目 同左	層位
*石田志朗	58	京大理地鉱	606	京都市左京区岩倉三宅町250-5	層位，古植物
石黒義人	76	名古屋工大	457	名古屋市南区西桜町5	古生代軟体動物
*石井　醇	58	東京学芸大地学	158	東京都世田谷区尾山台2-14-20	紡錘虫，層位
*石井健一	48	大阪市大理地学	565	大阪府吹田市青山台4-12-10	生層位，紡錘虫
*石島　渉	35	立教大	167	東京都杉並区桃井1-20-8	石灰藻
石川　正	67		250-01	神奈川県南足柄市塚原706	
*石和田靖章	51	石油開発公団技術センター	156	東京都世田谷区松原3-5-9	有孔虫，石油地質
*石崎国熙	60	東北大理地質古生物	985	宮城県多賀城市留ケ谷御屋敷23-9	貝形類，古生態
礒田喜義	75	東京農大第二高校	370	群馬県高崎市元島名町523	花粉
礒見　博	51	地質調査所	153	東京都目黒区駒場1-26-26	層位，有孔虫
伊藤　真	72	県立和光高	300-32	茨城県新治郡桜村栗原3269-4 片岡方	層位，古生物
*糸魚川淳二	53	名大理地球科学	464	名古屋市千種区にじが丘西9-305	古生態，軟体動物
岩井淳一	36		980	仙台市荒巻北鷺ケ森5-68	層位（新，中生代）
*岩井武彦	46	弘前大教育地学	036	弘前市森町13	新生代軟体動物，層位
岩尾雄四郎	76	佐賀大理工土木	840	佐賀市本庄町大字本庄373-8	古植物
岩崎泰頴	61	熊本大理地学	860	熊本市黒髪2-39-1 同左	新生代軟体動物(分類，生態)

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神保幸則	67	本州製紙(株)	158	東京都世田谷区瀬田4-17-7	軟体動物
実崎悟郎	69	碩信高	870-03	大分市屋山426	生層位，紡錘虫

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鎌田浩毅	57	石油資源開発(株)	235	横浜市磯子区洋光台2-1-2-202	石油地質，生層位，有孔虫

*鎌田泰彦	1948	長崎大教育地学	852	長崎市昭和町452-277	新生代軟体動物，層位 海洋地質
*神戸信和	46	地質調査所	165	東京都中野区中央2-49-11	地史，古生物
*亀井節夫	55	京大理地鉱	606	京都市左京区松ガ崎今海道町18	脊椎動物（長鼻類）
亀山徳彦	67	北九州大	811-34	福岡県宗像郡宗像町日の里5-1-22-105	新生代小型有孔虫
金森邦夫	71	イラン石油(株)	100	東京都千代田区永田町2-4-11　同左	有孔虫
金杉洋美	72	筑波大地球科学	300-31	茨城県新治郡桜村花室第2住宅209-215	古生物
*金谷太郎	48	金谷ホテル(株)	321	栃木県日光市上鉢石町1300	微古生物，珪藻
神田　要	74	早稲大教育地学	160	東京都新宿区戸塚町1-647　同左	新生界層位，小型有孔虫
金子寿衛男	53		591	大阪府堺市新金岡町3-1-16-101	軟体動物
蟹江康光	61	横須賀市立博物館	239	横須賀市馬堀海岸1-1，B-103	白亜紀軟体動物，層位
*勘米良亀齢	48	九大理地質	813	福岡市東区大字松崎香椎ヶ丘528	層位，紡錘虫
*菅野三郎	53	筑波大地球科学	177	東京都練馬区石神井町7-11-1	新生代軟体動物，生層位
鹿股信雄	66	千葉大理地学	170	東京都豊島区北大塚3-18-19	
間舎美幸	74	東教大理地鉱	135	東京都江東区富岡1-13-5	古植物
*鹿沼茂三郎	50	東京学芸大	181	東京都三鷹市上連雀6-11-13	紡錘虫
加瀬友喜	76	東大理地質	272-01	千葉県市川市大洲2-2-21	軟体動物
鹿島愛彦	64	愛媛大理地質	790	松山市東長戸町156 愛媛大宿舎413	古生界層位
片山貞昭	50		730	広島市牛田旭1-11-1	生層位
加藤穣司	64	山本産業(株)	171	東京都練馬区東大泉町314-11	バクテリア
*加藤　誠	54	北大理地鉱	062	札幌市中之島1-7 合同宿舎404-25	サンゴ類
加藤又二郎	58		061-31	札幌市篠路町拓北76-47	
加藤道雄	70	広島大総合科学部	733	広島市吉島東2-17-6-306	化石層位，有孔虫
加藤　進	73	名大理地球科学	452	名古屋市西区平中町180	
嘉藤良次郎	48	名大教養地学	465	名古屋市名東区平和ヶ丘3-13 平和ヶ丘住宅1-603	新生代地質
*甲藤次郎	60	高知大文理地質	780	高知市升形8-40	分類，プロブレマチカ等
川辺鉄哉	66	千葉大理地学	280	千葉市小中台町877 千葉大北宿舎1C-10	中生代軟体動物
河田茂磨	48		336	浦和市前地2-3-5	生層位，有孔虫
河合正虎	50	川崎地質(株)	233	横浜市港南区日野町4288 めじろ4-405	生層位，二枚貝
川上　広	74		517-05	三重県志摩郡阿児町神明	層位，古生物
川上　享	72	三菱石油開発(株)	156	東京都世田谷区船橋7-8-2-510	石油地質
*河野通弘	54	山口大教育地学	753	山口市宝町3-54	層位，紡錘虫
川沢啓三	66	高知追手前高	780	高知市井口町129	古，中生界生層位
菊池勘左ヱ門	36	佐渡博物館	952-34	新潟県両津市下久知	軟体動物
菊池良樹	54	イラン石油(株)	186	東京都国立市西3-2-2	石油地質
木村秀雄	64		983	仙台市五輪2-5-28	
*木村達明	51	東京学芸大地学	177	東京都練馬区南大泉40	古植物
*木村敏雄	41	東大理地質	222	横浜市港北区仲手原2-25-32	構造地質
木下　勤	71	東京学芸大地学	121	東京都足立区竹の塚5-8-12	コノドント，層位
北村健治	66	明星学苑	197	東京都福生市福生1530-13-305	層位，三角貝
北里　洋	71	東大理地質	113	東京都文京区本郷7-3-1　同左	有孔虫

*小島信夫	1935	親和女子大	662	兵庫県西宮市甲子園２番町2-6	地史，古植物
小林文夫	71	東教大理地鉱	184	東京都小金井市貫井北町2-6-17 矢崎方	紡錘虫
*小林巌雄	58	新潟大理地鉱	951	新潟市関屋本村町1-150 合同宿舎	化石硬組織（二枚貝）
小林学	54	文部省初中局	177	東京都練馬区西大泉町2051-1	紡錘虫
小池裕子	75		177	東京都練馬区石神井台3-12-6	人類学
*小池敏夫	62	横浜国大教育地学	240	横浜市保土ケ谷区岩井町271 横浜国大岩井宿舎51号	コノドント
*小泉格	64	大阪大教養地学	570	大阪府枚方市御殿山南町4-3646	生層位，珪藻
小泉斉	65	東建地質調査(株)	280	千葉市高洲2-2-1-406	三葉虫，腕足類
*粉川昭平	60	大阪市立大理生物	630	奈良市六条緑町2-156	古植物
小村精一	74	石油資源開発(株)	350-13	埼玉県狭山市青柳63 新狭山ハイツ13-303	微古生物
紺田功	71	奈良高	639-11	奈良県大和郡山市呉竹町28	微古生物（有孔虫）
*小西健二	48	金沢大理地学	920	金沢市涌波2-7-10 大学宿舎Ｄ-9	生態，同位体古生物，藻類
*小高民夫	48	東北大理地質古生物	982	仙台市桜木町18-18	軟体動物，生層位，生物測定学
古藤次郎	53		171	東京都豊島区南長崎町4-20-10	
久次米旭	71	(株)応用地質調査事務所	733-02	広島市可部町大字城872-1	生層位，アンモナイト
栗原謙二	66	立教大	171	東京都豊島区西池袋2-39-3	新生代有孔虫
黒田秀隆	50	サンコーコンサルタント(株)	235	横浜市磯子区洋光台4-9-7	応用地質
黒沢利衛	74	科学飼料研	370-12	群馬県高崎市宮原町8	分析化学
*楠見久	50	広島大教育東雲分校	734	広島市己斐上4-286-200	生層位，生態，貝エビ類
*桑野幸夫	51	国立科学博	223	横浜市港北区日吉本町1797	微古生物(コノドント，有孔虫)

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*馬淵精一	35		184	東京都小金井市貫井南町4-18-3	層位
*前田四郎	51	千葉大理地学	272	千葉県市川市菅野2-3-7	
前田保夫	63		657	神戸市灘区桜ケ丘町10-45	花粉
米谷盛寿郎	68	石油資源開発(株)技研	185	東京都国分寺市日吉町4-16-15	有孔虫
丸山文男	70	県立甲陵高	891-11	鹿児島県日置郡郡山町100　同左	
正谷清	58	アラカン石油開発(株)	359	埼玉県所沢市北秋津461-8	三角貝，石油地質
増田富士雄	70	東教大理地鉱	233	横浜市南区大岡2-4-3	地球化学，層位
*増田孝一郎	52	宮城教育大地学	983	仙台市旭ケ丘2-25-6	新生代軟体動物
*的場保望	62	秋田大鉱山鉱山地質	010	秋田市手形休下町9-33 秋田大宿舎	有孔虫
松田丞司	73	国際航業(株)	813	福岡市東区香住ケ丘6-28-12 国際航業(株)香住ケ丘寮	層位
松田哲夫	75	大阪市大理地学	612	京都市伏見区向島庚申町96-7	コノドント，生層位
松川正樹	72	府中西高	154	東京都世田谷区弦巻2-12-20	軟体動物（アンモナイト）
松隅明彦	69	九大教養地学	819-13	福岡県糸島郡志摩町松隅101	古生態
*松丸国照	66	埼玉大教育自然科学	338	浦和市下大久保255　同左	生層位，大型有孔虫
松本英二	62	国立科学博	157	東京都世田谷区上祖師谷5-21-12 渡辺方	軟体動物

*松本達郎	1935	九大理地質	815	福岡市南区南大橋町1246	白亜紀頭足類，生層位
松永二三郎			272	千葉県市川市本北方3-2-5	層位，堆積
*松永孝	48		221	横浜市神奈川区松ヶ丘76	
*松尾秀邦	48	金沢大教養地学	921	金沢市弥生1-26-7	新植代植物
松尾康弘	67	明法高	167	東京都杉並区松庵3-16-25	
松岡数充	71	大阪市大理生物	619-02	京都府相楽郡精華町祝園29	小型プランクトン
松島義章	68	神奈川県立博物館	231	横浜市中区南仲通5-60　同左	層位，軟体動物
*松下久道	35	九大理地質	810	福岡市高砂2-24-25	
*松下進	35	奈良大	606	京都市左京区吉田上阿達町30	層序
三井さち子	76	広島大理地鉱	733	広島市舟入幸町8-1	炭酸塩岩
三上貴彦	62	山口大文理地鉱	753	山口市平井 山口市営住宅26	層位，紡錘虫
三木昭夫	67	芙蓉石油開発(株)	170	東京都豊島区駒込1-33-4	花粉
三木孝	70	九大理地質	815	福岡市中央区平尾5-22-23	中,新生界層位
皆川信弥	37	山形大教養地学	990	山形市小白川町1-2-52	生層位
箕浦幸治	73	東北大理地質古生物	983	仙台市小田原金剛院丁1-4 小原方	六射サンゴ
三谷勝利	62	北海道立地下資源調査所	062	札幌市月寒東3条3丁目	層位
光井久	74	北海道炭礦汽船(株)地調	068-04	北海道夕張市末広1-106	
三井忍	66	高知大文理地質	780	高知市朝倉甲481-1 高知大勝負の川地区宿舎1-24	構造地質
宮田雄一郎	73	九大理地質	812	福岡市東区箱松2-26-2 石原方	
*水野篤行	51	地質調査所	244	横浜市戸塚区平戸町1385-14	海洋地質，新生代軟体動物
水谷伸治郎	56	名大理地球科学	465	名古屋市千種区代万町2-21	
森群平	52		939-07	富山県下新川郡朝日町泊454	軟体動物，植物
*森啓	62	東北大理地質古生物	980	仙台市青葉山　同左	層孔虫
森忍	75	名大理	458	名古屋市緑区有松町大字桶狭間字愛宕西23-752	珪藻
*森下晶	47	名大理地球科学	458	名古屋市緑区鳴海町細根 鳴海住宅21-13	新生代ウニ，生層位
両角芳郎	69	大阪市立自然史博	583	大阪府羽曳野市翠鳥園6-15	新生代有孔虫，層位
*村井貞允	51	岩手大工資源開発	020	盛岡市北山2-14-36	新生代植物
村松二郎	76	千葉大教育	180	東京都武蔵野市西久保2-18-3	紡錘虫
村松憲一	70	名大理	466	名古屋市昭和区長戸町6-18	層位
村本喜久雄	74	三笠病院	068-22	北海道三笠市弥生花園町42	
村本辰雄	63		068-22	北海道三笠市弥生花園町28-137 村本標本室	
*村田正文	56	熊本大理地学	860	熊本市黒髪2-39-1　同左	古生代軟体動物，サンゴ,コノドント,紡錘虫

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長井孝一	76	九大理地質	808	北九州市若松区東小石町15-3	生層位，石灰岩堆積
永井浩三	60		790	松山市湯渡町5-29	層位，古植物
永井節治	76		399-53	長野県木曽郡南木曽町読書4018-3	軟体動物
長尾捨一	61	サンコー・コンサルタント(株)	063	札幌市琴似町山の手2条4-34	生層位，古植物
*永沢譲次	35	成徳学園	165	東京都中野区江古田2-22-14	軟体動物，哺乳類，古生態
長瀬和雄	62	神奈川県温泉研	241	横浜市旭区本村町57-6	

長田亨一	1969	石油資源開発(株)技研	184	東京都小金井市中町3-4-11	放散虫
内藤源太朗	57	防府商高	747	山口県防府市東松崎町9-26	古植物
仲川隆夫	73	新潟大教養地学	952-11	新潟県佐渡郡金井町吉井本郷859-7	
中道修	69	北川工業(株)	920	金沢市桜町7-14	
*中村耕二	58	北大教養地学	063	札幌市北区新琴似11条8丁目	ペルム紀腕足類
中村萬次郎	67	東京理科大理工	273	千葉県船橋市丸山町60	層位，藻類
*中野光雄	50	広島大理地鉱	737	広島県呉市三条1-13-25	三角貝
*中世古幸次郎	62	大阪大教養地学	565	大阪府吹田市桃山台3-18-4	生層序，放散虫
中沢克三	65		380	長野市大字若槻団地1-490	
*中沢圭二	48	京大理地鉱	603	京都市北区小山下内河原町42	軟体動物，生痕
成瀬武彦	67	航空自衛隊第四技術学校	369-03	埼玉県児玉郡上里町神保原町122	生層位，紡錘虫
*奈須紀幸	50	東大海洋研	164	東京都中野区中央1-50-3-101	海洋地質，堆積
名取博夫	62	地調燃料部	164	東京都中野区中央2-32，RA-46	第三紀有孔虫
根本修行	74	千葉大教育	280	千葉市轟町2-3-3 京増とり方	軟体動物
新妻信明	66	東北大教養地学	980	仙台市荒巻鷺ヶ森6-22	有孔虫
西田史朗	67	奈良教育大地学	631	奈良市帝塚山1-1562-112	微古生物
*西田彰一	36	新潟大理地鉱	950-21	新潟市五十嵐二の町8050　同左	
西田民雄	62	佐賀大教育地学	840-01	佐賀市日ノ出1-18-64	古生代軟体動物
西川功	53		720-18	広島県神石郡油木町油木乙1797	
西川誠	66		943	新潟県上越市仲町3-7-11	生層位，有孔虫
西川廉行	72	県立奈良工業高	630	奈良市法蓮呉竹町1514	層位
西宮克彦	71	山梨大教育地学	400	甲府市武田3-5-19	
西村明子	75	大阪大教養地学	565	大阪府豊中市新千里東町2-7 C20-102	
西村昭	75	京大理地鉱	605	京都市東山区山科大塚高岩1-18	有孔虫
西尾敏夫	36		177	東京都練馬区東大泉町368	新生界層位
西脇二一	67	京大理地鉱	606	京都市左京区北白川上池田町10 百成荘101号室	花粉，堆積
丹羽俊二	73	名大理地球科学	462	名古屋市北区辻町7-39	
*野田浩司	61	筑波大地球科学	300-31	茨城県新治郡桜村花室1290 筑波竹園3丁目住宅202-103	軟体動物
野田雅之	66	大分市立植田中	870	大分市深河内5組	
*野田光雄	35	福岡大理地質	815	福岡市南区三宅西大橋1225	
*野上裕生	57	京大理地鉱	616	京都市右京区鳴滝春木町5-23	
野原朝秀	69	琉球大教育地学	902	那覇市古波蔵365	貝形類，哺乳類
野村律夫	74	東北大理地質古生物	980	仙台市南鍛冶町163 佐藤方	有孔虫
沼野恭一郎	62		649-15	和歌山県御坊市名田町上野1465	

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*小島郁生	56	国立科学博	193	東京都八王子市めじろ台4-18-8	白亜紀頭足類
尾田太良	71	東北大理地質古生物	980	仙台市青葉山　同左	生層位，有孔虫
小笠原憲四郎	72	東北大理地質古生物	982	仙台市八木山本町2-23-6	軟体動物
小川久	62	瑞穂建材工業(株)	198	東京都青梅市長淵2-684-3	構造地質
小川賢之輔	52		417	静岡県富士市中里町3-164-4	層位
荻野繁治	68		233	横浜市港南区野庭町1469 野庭団地H6棟505号	

生越　忠	1948	和光大	194	東京都町田市鶴川2-11-3-103	
*小倉　謙	33	東大理植物	171	東京都豊島区西池袋5-20-12	古植物
大場忠道	66	東大海洋研	151	東京都渋谷区千駄ケ谷4-19-8 佐藤方	同位体地質
*大原　隆	63	千葉大教養地学	281	千葉市稲毛町5-122	新生代軟体動物
大越　章	74	新座市立八石小	210	川崎市川崎区渡田1-2-2-407	第四紀地質，軟体動物
大野照文	75	京大理地鉱	612	京都市伏見区ヨゴロ町桃山1-385	古生態
*太田喜久	57	福岡教育大地学	824-08	福岡県京都郡勝山町上久保1914	中生代非海棲二枚貝
*大炊御門経輝	35	イラン石油(株)	171	東京都豊島区長崎1-25-15	応用地質
*岡田博有	58	静岡大理地球科学	420	静岡市安東3-49-1-2 安東サツキマンション105	堆積
岡田　豊	74	東大理地質	277	千葉県柏市増尾94-43	貝形類
岡藤五郎	70	県立大嶺高	759-22	山口県美祢市大嶺町下領	脊椎動物
大上和良	69	岩手大工資源開発	020	盛岡市上田3-3-36	堆積
*岡本和夫	54	広島大教育東雲分校	735	広島県安芸郡安芸町温品353-17	第三紀軟体動物，層位
岡村長之助	70	岡村化石研	455	名古屋市港区甚兵衛通5-12	古生物
岡村　真	72	東北大理地質古生物	980	仙台市長町2-11-36 根岸荘	生層位，石灰質ナンノプランクトン
岡崎美彦	75	京大理地鉱	606	京都市左京区北白川下別当町29 猪飼一夫方	中新世哺乳類，三葉虫
岡崎由夫	62	北海道教育大釧路分校	085	釧路市住之江町11-24	花粉，地史
大木公彦	71	鹿児島大理地学	890	鹿児島市下伊敷町666 伊敷住宅2-106	層位，有孔虫
*沖村雄二	60	広島大理地鉱	730	広島市戸坂町桜ケ丘21-4	紡錘虫，堆積
奥田　尚	71		581	大阪府八尾市八尾木337	層位
奥村　清	76	神奈川県教育委員会	259-01	神奈川県中郡二宮町山西1026	第四紀地質
奥村好次	75	瑞浪市化石博	509-61	岐阜県瑞浪市明世町月吉587	古生物
*奥津春生	40		983	仙台市小松宮新堤14-1	環境地質
*大森昌衛	48	東教大理地鉱	177	東京都練馬区石神井台3-32-5	軟体動物(分類，系統)
*大村明雄	66	金沢大理地学	921	金沢市弥生1-28-11	同位体古生物学
大村一夫	65	ダイヤコンサルタント(株)	470-03	愛知県豊田市東保見町山洞 保見団地公団140-203	層位
小村達夫	37	岡山大理生物	701-14	岡山市足守861	動物発生学
小野寺信吾	57	岩手県立大東高	021	岩手県一関市桜木町3-30	哺乳動物
*尾上　亨	56	地質調査所	196	東京都昭島市中神町1259	新生代植物
*小貫義男	36	(株)長谷地質調査事務所	980	仙台市国見2-15-5	生層位
長田敏明	74	都立大理地理	140	東京都品川区勝島1-7 4-301	内湾の貝類
押手　敬	55	北海道教育大函館分校	040	函館市八幡町1-2　同左	生層位，珪藻
*太田正道	63	秋吉台科学博	754-05	山口県美祢郡秋芳町秋吉上里	紡錘虫，四射サンゴ類
太田信機	67		807-11	北九州市八幡区楠橋宮の下1726	堆積
*大塚裕之	64	鹿児島大理地学	892	鹿児島市吉野町333-2 大明ケ丘公務員住宅5の11	新生代哺乳類
大塚雅勇	76	県立松橋東養護学校	862	熊本市健軍町2233-9	環虫類，層位
*大山　桂	36	地質調査所	162	東京都新宿区市ケ谷河田町8　同左	軟体動物
*大山年次	37	茨城大	309-01	茨城県北相馬郡藤代町谷中208	古植物
*尾崎　博	35	国立科学博	167	東京都杉並区天沼2-5-29	新生代軟体動物

尾崎公彦	1967	横浜国大教育地学	221	横浜市神奈川区新子安1-29-3-42	古植物
小澤智生	66	東大理地質	186	東京都国立市中3-3-15	紡錘虫，Umboninae

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*佐田公好	60	広島大総合科学	734	広島市翠町1132 グリーンシャトー203号	紡錘虫，サンゴ類
斎藤実	70	香川大農	761-01	高松市屋島西町2074	生層位，軟体動物
斎藤隆	68	石油開発公団	100	東京都千代田区日比谷内幸町2-1-4 日比谷中日ビル　同左	
*斎藤登志雄	48	茨城大理地学	310	水戸市文京1-10-7	層位，堆積
斎藤靖二	64	国立科学博	131	東京都墨田区東向島3-25-3	堆積岩
斎藤豊	71	信州大教育地学	380	長野市吉田2-12-19	
*坂上澄夫	54	愛媛大教育地学	790	松山市東長戸町156 愛媛大宿舎131号	コケ虫類，コノドント，紡錘虫
*坂口重雄	39	大阪教育大	565	大阪府豊中市新千里東町2-5，A1-201	層位，紡錘虫
酒井豊三郎	70	東北大理地質古生物	983	仙台市原町南目薬師堂西28-5	新生代放散虫
*坂倉勝彦	35	中東石油(株)	157	東京都世田谷区成城9-20-3	燃料地質
坂本峻雄	40	住友商事(株)	150	東京都渋谷区神宮前1-6-11	地質
桜井欽一	35		101	東京都千代田区神田須田町1-15	
佐俣哲郎	74	東教大理地鉱	248	神奈川県鎌倉市稲村千崎5-10-21	微古生物
笹川清一	68	石油資源開発(株)長岡鉱業所	940	新潟県長岡市城岡2-11-11　同左	生層位，有孔虫
佐々木衛	76	新潟大教養地学	950-21	新潟市五十嵐二の町8050　同左	
佐藤二郎	64	岩手県教育委員会	023	岩手県水沢市表小路1-78	古魚類
佐藤幸二	51	(財)中央温泉研	188	東京都田無市芝久保町1-5-3	温泉地質
*佐藤誠司	61	北大理地鉱	062	札幌市平岸木の花団地6-206	生層位，花粉
*佐藤正	53	筑波大地球科学	300-31	茨城県新治郡桜村竹園3-702-201	中生代頭足類，構造地質
沢秀生	52	御船高	861-32	熊本県上益城郡御船町辺田見328	地質
沢田義男	50	室蘭工大開発工	050	室蘭市水元町32-2-202	生層位，軟生動物
沢村孝之助	64	地調北海道支所	060	札幌市中央区南1条西18丁目　同左	珪藻
讃良紀彦	69	石油資源開発(株)	064	札幌市中央区南21西7　同左	生層位，有孔虫
関戸信次	62	石川県教育センター	923	石川県小松市本大工町1-23	古植物
柴田晃	69	新見高	718	岡山県新見市高尾217-2	古生物
柴田博	64	名大理地球科学	470-11	愛知県愛知郡豊明町大字栄字殿山28-32	地史，貝
柴田豊吉	46	東北大理地質古生物	982	仙台市向山2-11-5	
志井田功	56	名大教養地学	462	名古屋市北区名城町2-1 名城住宅6-109	層位
*鹿間時夫	35	横浜国大教育地学	235	横浜市磯子区中原4-5-1	脊椎動物
島倉巳三郎	36		630	奈良市紀寺新屋敷町381-5	
嶋崎統五	73	石油資源開発(株)技研	335	埼玉県蕨市北町2-7-14	花粉
清水大吉郎	54	京大理地鉱	606	京都市左京区田中西樋ノ口町48	腕足類，古生界層位
清水照美	70	日本地科学社	603	京都市北区小山下総町15	地学教育
下山正一	74	九大理地質	812	福岡市東区箱崎6-10-1　同左	古，中生界層位
新保久弥	51	石油資源開発(株)技研	270	千葉県松戸市五香六実7-324	有孔虫，生層位
新谷俊雄	56	国際教育情報センター	156	東京都世田谷区桜1-12-10	古生物，哺乳類

塩原鉄郎	1955	弘前大教育	036	青森県弘前市学園町1-32-14-A	有孔虫
白神　孝	69	全日本コンサルタント(株)	581	大阪府八尾市美園町1-17-9	応用地質
白井健裕	58	新潟大教育地学	950-21	新潟市青山1144-3	新生界層位，有孔虫
白石成美	70	県立佐世保高	857-01	長崎県佐世保市吉岡町1027-7	新生代古生態
下中昌樹	75	美方高	917	福井県小浜市今宮34	微古生物(珪質微化石)
*首藤次男	50	九大理地質	815	福岡市南区長丘2-21-19	新生代軟体動物
傍島竹史	76	東濃高	505	岐阜県美濃加茂市野笹町1-7-12 教員アパートB-203	コノドント
曾我部正敏	51	地調燃料部	174	東京都板橋区清水町92-11-407	層位
菅野耕三	69	大阪教育大	581	大阪府八尾市八尾木22-2 八尾合同宿舎814	放散虫
菅谷政司	74	千葉大教育	311-11	茨城県東茨城郡常澄村東前1235	生層位（紡錘虫）
杉本幹博	66	金沢大教育地学	920	金沢市丸の内1-1 金沢大教育地学	層位
杉村昭弘	68	秋吉台科学博	754-05	山口県美祢郡秋芳町秋吉1876	コケ虫類
杉田福松	75	大阪教育大	581	大阪府八尾市南本町7-2-34	腔腸動物，中生代層孔虫
杉田宗満	61	岡山大理地学	700	岡山市津島中１丁目ＲＢ504	構造地質
角　靖夫	58	地質調査所	235	横浜市磯子区洋光台5-6-22-302	層位
角倉泰彦	48	神戸製鋼(株)	247	横浜市戸塚区上郷町1087-308	層位
*須鎗和巳	48	徳島大教養	770	徳島市八万町大坪232-1 公務員宿舎3-11号	層位
鈴木陽雄	42	宇都宮大教育	329-21	栃木県矢板市川崎241	層位
*鈴木敬治	48	福島大教育地学	960	福島市渡利転石16-3	古植物
鈴木康司	48	都立教育研	182	東京都狛江市岩戸543	層位
鈴木三男	73	東大農森林植物	136	東京都江東区東砂8-12，1-503	材化石
鈴木順雄	61	北海道教育大釧路分校	085	釧路市桜ケ丘4-7 合同宿舎1-36	古植物
鈴木達夫	35		166	東京都杉並区阿佐ケ谷南1-2216	

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*橘　行一	61	岩手大教育地学	020	盛岡市上田3-18-22	層位古生物，腕足類
多田元彦	66	岩手大工資源開発	020	盛岡市北山2-14-36 岩手大宿舎	層位，堆積
*多井義郎	50	広島大総合科学	734	広島市元宇品町27-10	新生界層位，有孔虫
平　一弘	67	北海道教育大旭川分校	070	北海道旭川市北門町９丁目　同左	同位体地質
*高橋英太郎	35	山口女子大	753	山口市宮野下上恋路1190-5	古植物（中，新生代）
*高橋治之	60	茨城大理地学	310	水戸市東原3-3-41	中生代頭足類，層位
*高橋　清	54	長崎大教養地学	852	長崎市三川町1300-34	花粉
高橋　和	64	西条市立東中	799-11	愛媛県周桑郡小松町妙口728	花粉
*高井冬二	35	東大理地質	112	東京都文京区小日向1-9-4	脊椎動物
高野　修	73	石油資源開発(株)	064	札幌市中央区南13西23 石油開発伏見アパート2-15	石油地質
高岡善成	51	桐棚高	187	東京都小平市上水本町1515	
*高山俊昭	62	金沢大教養地学	920	金沢市丸ノ内1-1　同左	微古生物（ナンノプランクトン，有孔虫）
*高柳洋吉	48	東北大理地質古生物	982	仙台市長町芦ノ口60-933	中，新生代有孔虫
*高安泰助	51	秋田大鉱山鉱山地質	010	秋田市旭南2-5-23	新生代軟体動物

武智雅美	1970	広島市立吉田小	734	広島市西本浦町18-15 すみれコーポ201	新生代軟体動物
竹原平一	35		466	名古屋市昭和区福原町3-16	層位
武永重夫	57		255	神奈川県中郡大磯町東小磯374	層位
武南　馨	56	都立福生高	191	東京都日野市新町3-15 日野新坂下住宅7-108	地学教育
竹内貞子	64		980	仙台市上杉3-9-12	花粉
滝沢　茂	71	筑波大地球科学	300-21	茨城県筑波郡谷田部町要害住宅前 坂本勝美方	コノドント
田宮良一	69	山形県庁	990	山形市東原町1-3-24	層位
*田村　実	51	熊本大教育	861-21	熊本市花立4-131	中生代二枚貝
棚部一成	71	九大理地質	812	福岡市東区貝塚団地15-13	機能形態，中生代アンモナイト
*棚井敏雅	48	北大理地鉱	062	札幌市豊平区平岸1条5丁目 平岸スターハイツB5-201	古植物
*田中啓策	58	地調地質部	158	東京都世田谷区上用賀4-36 D-504	層位
田中邦雄	48	信州大教養地	390	長野県松本市元町3-8-26	生層位，軟体動物
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*田代正之	63	尚絅高	774-29	熊本県上益城郡益城町馬水	中生代二枚貝
*立岩　巌	35		155	東京都世田谷区代田6-27-3	
田沢純一	72	東北大理地質古生物	982	仙台市富沢字金山1-2 東北大職員寮	層位，腕足類
*徳永重元	44	日本肥糧(株)	160	東京都新宿区百人町2-17-18	花粉
徳山　明	54	静岡大教育地学	420	静岡市小鹿3-5-1 小鹿住宅3-45	構造地質，層位，中生代腕足類，軟体動物
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*鶴田均二	35	帝国石油(株)	113	東京都文京区西片2-7-15	石油地質

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打矢貞子	69	秋田商業高	010	秋田市八橋字八橋125-2	新生代有孔虫
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*氏家　宏	53	国立科学博	191	東京都日野市平山2-18-7	有孔虫
*魚住　悟	51	北大教養地学	060	札幌市南13条西22丁目	分類，生態，軟体動物
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渡 辺 其久男	69	石油資源開発(株)	950	新潟市本馬越756-4	生層位，有孔虫
渡 辺 耕 造	68	野田高	278	千葉県野田市宮崎77	紡錘虫，コノドント
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*山 際 延 夫	55	大阪教育大地学	591	大阪府堺市新金岡町3-1,14-102	腔腸動物，紡錘虫
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*山 崎 達 雄	53	九大生産科学研	813	福岡市東区香住ケ丘6-19	層位（第三系）
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*柳 田 寿 一	58	九大理地質	816	福岡県春日市東弥永227	古生代腕足類
柳 沢 一 郎	67	県立磐城高	970	福島県いわき市平字幕の内田中1	層位，腕足類，二枚貝
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横 尾 浩 一	73	都立明正高	158	東京都世田谷区中町2-20-26 和泉苑	
横 山 道 昭	71	広島大理地鉱	730	広島市舟入南町4-1-37-5101 野崎方	古生代腕足類
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吉 田 新 二	50	愛知教育大	467	名古屋市瑞穂区田光町2-36	層位，堆積
吉 田 尚	42	地質調査所	211	神奈川県川崎市高津区野川3777-8	古生代コノドント
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由 井 誠 二	72	インドネシア石油資源開発(株)	332	埼玉県川口市前川町3-1313 中銀蕨マンション302	軟体動物（分類，古生態）

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神 保 悳	36		990	山形市飯塚町62	層位，海棲有殼軟体動物

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例会等の通知

	開催地	開催日	講演申込締切日*
1977年総会・年会	東京学芸大学	1977年1月21,22日	1976年11月15日
119回例会	静岡大学	1977年6月18日	1977年4月15日
120回例会	熊本大学	1977年10月16日	1977年8月15日

* 講演申込み締切日は，開催予定日の2ケ月前を原則とします。早目にお申込み下さい。

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昭和52年度の下記のような各種奨励金に本会の推薦を希望される場合は，**昭和52年2月25日までに**，① 研究者および協力者氏名所属 ② 希望される奨励金名称 ③ 課題名と大略の内容を記して，東京大学理学部地質学教室気付日本古生物学会賞の委員会事務局あて申込まれたい。
○ 朝日学術奨励金　金額に制限なし，研究進行中，またはこれから始めるもの。学会関係者の推薦を要する。締切3月1日。
○ 三菱財団自然科学研究助成金　1件3,000万円以内（300～1,000万円程度），重点対象分野の指定あり，推薦は不要，助成期間は原則として1年間，締切5月末頃。
なお上記の締切日は昭和51年度のものであるから，52年度には多少変更があるかも知れない。（従来上記のほかに毎日学術奨励金，山路自然科学振興財団研究助成金があつたが，51年度から廃止された）。

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