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GEOLOGICAL SURVEY OF JAPAN

**ON THE NEW MIOCENE UNIONIDS
FROM THE SASEBO COAL FIELD,
WESTERN JAPAN**

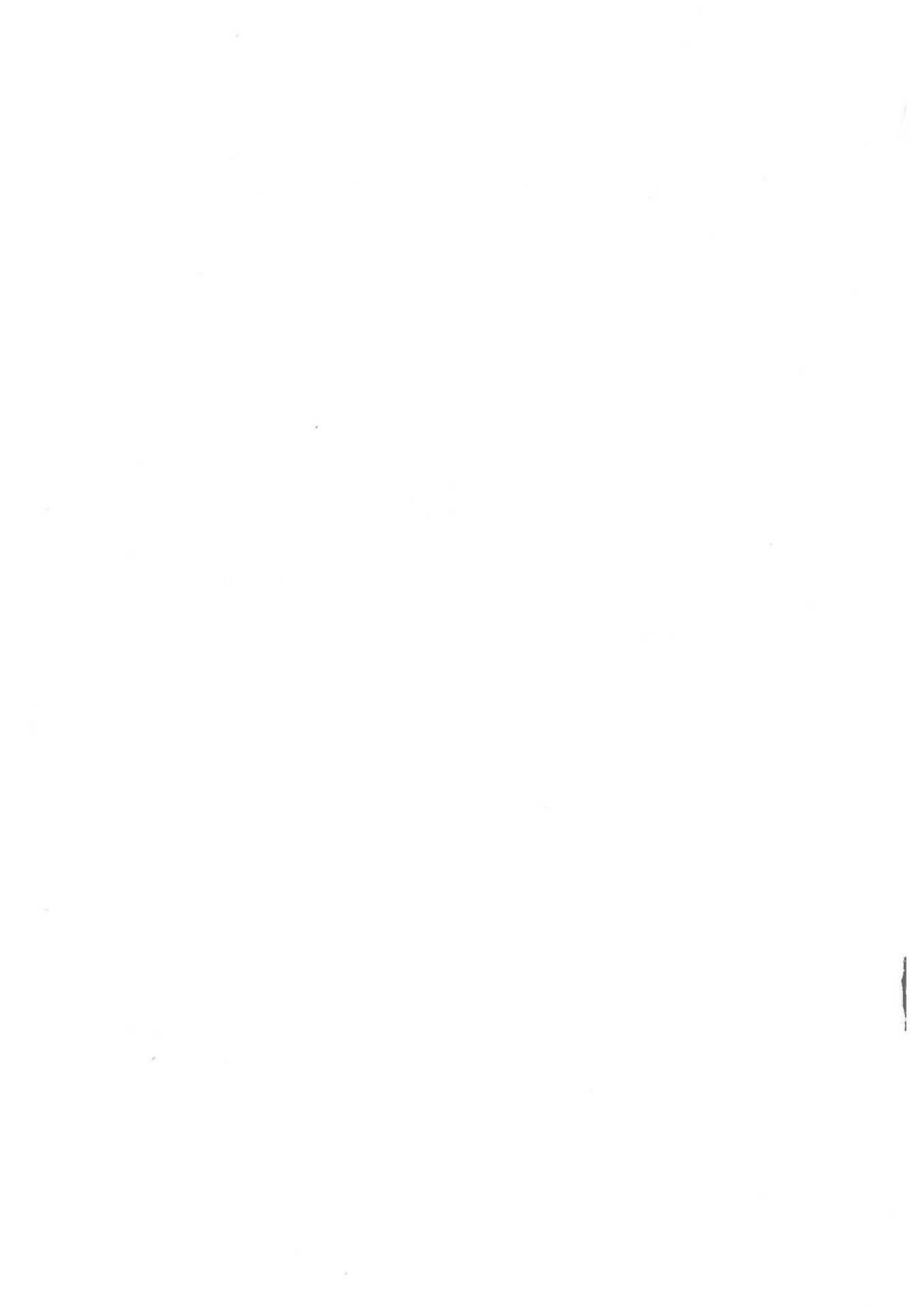
By

Atsuyuki Mizuno

GEOLOGICAL SURVEY OF JAPAN

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Konosuke SATO, Director

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CONTENTS

	Page
Abstract	1
I. Introduction.....	1
II. Summary of the Neogene stratigraphy and molluscan fauna in the Sasebo coal field	1
III. Characteristics of the Neogene fresh-water fauna in the Sasebo coal field	4
IV. Description of new species	6

On the New Miocene Unionids from the Sasebo Coal Field, Western Japan

By
Atsuyuki MIZUNO

Abstract

Among the collection of fossils in the Geological Survey of Japan, the writer found seven new species of fresh-water pelecypod fossils which occurred from the Miocene Sasebo and Nojima groups in the Sasebo coal field. They are: *Lamprotula uejii* n. sp., *L. nagahamai* n. sp., *L. divaricata* n. sp., *Cuneopsis nagahamai* n. sp., *C. praeambiguus* n. sp., *C. pseudobarbouri* n. sp. and *Lepidodesma japonica* n. sp. In the present paper these new species are taxonomically described and faunal occurrences in both the groups of the Sasebo coal field are accounted. The fauna particularly represented by that of Nojima which is characterized by many unionids is very similar to the late Cenozoic non-marine faunas in Chinese continent. But it is noticeable that in Japan the fauna very predominant in the "Lamprotulinae" including *Lamprotula* and *Cuneopsis*, as shown in the Nojima fauna, seems to have appeared earlier, which obtained complicated ornaments also earlier than in the continent.

I. Introduction

The Neogene geology of the Sasebo coal field in the northwestern Kyushu was first elaborated by UEJI (1938)'s study. His contributions also clarified the occurrences of Tertiary fresh-water molluscan fauna, very similar to those in the Chinese continent, from the coal field (UEJI, 1934 a, b). Thereafter, intensive works have been achieved by many investigators, and now we have the detailed informations on the geology and faunal occurrence of the area.

Some ten years ago, through their field works, T. NAGAHAMA, T. TANAI and H. SAWATA have collected many non-marine molluscan fossils, which have been kept in the Geological Survey of Japan. The writer's examination of these fossils clarified seven new species of *Lepidodesma*, *Lamprotula* and *Cuneopsis*. These genera found in the recent fresh-water bottom fauna of the Chinese continent are not living today in the Japanese Islands area. In this paper, the new species are described and also the characteristics of the fauna and some related problems are briefly discussed.

The writer manifests his sincere thanks to Dr. H. NAGAHAMA, one of the collectors, who kindly offered the information on geology of the Sasebo coal field to the writer. Thanks are also due to Dr. K. OYAMA, who gave some suggestions on taxonomy to the writer.

II. Summary of the Neogene stratigraphy and molluscan fauna in the Sasebo coal field

In the Sasebo coal field, the thick Neogene sequence more than 3,000 m in thickness is developed upon the Kishima group which is regarded as the upper Oligocene Nishisonogian stage. The latter is wholly composed of purely marine facies, while the former is represented by paralic facies, characterized by many coal seams particularly in its lower-middle parts. The Neogene sequence is divided into the Sasebo group, Nojima group and Hirado formation,

in ascending order (NAGAHAMA, 1954). The former two groups are subdivided into some formations respectively as shown in the following table.

Table 1 Neogene stratigraphic sequence in the Sasebo coal field
(after NAGAHAMA, 1954)

		Hirado formation	
		~~~~~ ? ~~~~~	
	Nojima group	{	Minamitabira formation
			Fukazuki formation (+)
			Oya formation (+)
		~~~~~	
Neogene	Sasebo group	{	Kase formation *
			~~~~~
			Fukui formation +*
			Sechibaru formation +
			Yunoki formation +
			Nakazato formation +*
Ainoura formation +*			
		~~~~~ ? ~~~~~	
Paleogene		Kishima group	

Remarks on the occurrence of molluscan fossils: * marine form
+ non-marine form
(+) exclusively fresh-water form

The Sasebo group attaining about 1,000m in thickness consists of sandstone, mudston and coal seams, and bears marine and non-marine molluscan fossils and plant fossils in some horizons. From the lithological and paleontological viewpoints, it exhibits a recurring sequence of shallow marine, lagoonal, estuarine or lacustrine facies. On the other hand, the Nojima group is largely occupied by non-fossiliferous alternation of sandstone and mudstone, but in its lowest part, namely Oya formation and the lowest part of Fukazuki formation, a large amount of andesitic pyroclastics is found, and moreover many fresh-water molluscan fossils are comprised. The occurrences of molluscan fossils from the above-said groups have been known many years since.

Paying an attention to the characteristics of marine molluscan fossils of about twenty species, which are particularly found in the upper Ainoura formation, middle Fukui formation and Kase formation, the writer proposed the Saseboan stage to the whole Sasebo group (MIZUNO, 1963, 1964).

From the Sasebo group, besides the marine forms some non-marine species are occurred. They are represented by *Corbicula matsushitai*, *Corbicula nakayamana*, *Corbicula hizenensis*, *Corbicula procera*, *Semisulcospira* sp., *Cuneopsis pseudobarbouri* n. sp., *Lamprotula nojimensis*, *Lamprotula* sp. etc. Of them, the new species of *Cuneopsis* to be described in this article was found from dark grey mudstone at the horizon of 25m above the coal seam "Shinden-Goshaku" situated at the middle-upper part of the Ainoura formation, together with *Corbicula procera*.

In the lower part of the Nojima group, there are recognizable two remarkable fossil beds. One is represented by that of the lower part of Oya formation and another is shown by that of

the lowest part of Fukazuki formation.

From the Oya formation the following fossils are occurred mainly in dark grey fine to very fine-grained sandstone.

Lamprotula uejii n. sp.
Lamprotula nagahamai n. sp.
Lamprotula divaricata n. sp.
Lamprotula nojimensis UEJI
Cuneopsis ? sp.
Lepidodesma japonica n. sp.
Lepidodesma uejii KURODA
Hirioopsis matsuuensis UEJI
Bellamyia kosasana (UEJI)

Among these fossils, *Bellamyia kosasana* is characteristically yielded in some beds in which the fossils abundantly crowd. The beds are scattered in 25–30m thick part of the middle part of the Oya formation. In most cases the beds are almost occupied by *Bellamyia*, but rather a small amount of unionid fossil is intermingled in general. The unionid fossils listed above were found in such a manner. These fossil beds are widely distributed throughout the Sasebo coal field.

The Fukazuki formation also yields viviparid and unionid fossils in certain area together with *Corbicula* sp. They are as follows.

Parreysia sp.
Lamprotula sp.
Cuneopsis nagahamai n. sp.
Cuneopsis praeambiguus n. sp.
Bellamyia sp.

According to NAGAHAMA (1954), *Bellamyia* just cited is somewhat larger in size and exhibits slightly different form, compared with the genus found in the Oya formation.

By many authors the Oligocene or Oligo-Miocene age of the Sasebo-Nojima groups has been generally accepted before Nagahama's studies (1953, -54), who found some lower-middle Miocene type molluscan fossils from the Sasebo group and first designated the group to lower-middle Miocene and the Nojima to upper Miocene. From a floral viewpoint, TANAI and ONOE (1956) manifested their views that the Ainoura formation belongs to the lower Miocene and the horizon upper than the Nakazato formation to the middle Miocene. Moreover, TANAI (1961) considered the whole Nojima group as the middle Miocene and correlated it with the Nishikurosawa and Daishima formations of the northeastern Japan. On the other hand, SHUTO (1963, 1964) attributed the Oya formation of the Nojima group to the Helvetian-Tortonian and correlated it with the lower half of the Miyazaki group on the southeastern Kyushu. Also he considered the Sasebo group as the Aquitanian-Burdigalian. Thus the Sasebo-Nojima groups are generally designated to Miocene today, though some disagreements are found in details.

In fact, in the Neogene sequence of the Sasebo coal field, non-marine molluscan fossils are rather abundantly found, but the marine forms are generally poor. This brings out some difficulty for the correlation of strata, because the Japanese Miocene deposits of another districts are predominant in the latter forms in general and very poor in the former.

In the northeastern Japan, based upon the faunal vicissitude of marine molluscs, two divisions, the Shiratorigawan and Mabechigawan stages, were established in the Miocene excluding its lower part exclusively occupied by non-fossiliferous volcanic deposits (AOKI,

1960). Both the stages are characterized by a peculiar faunal assemblage respectively.

In the western Japan, the Saseboan stage comprises two faunas that are stratigraphically separated, though the boundary can not be sharply defined. According to the writer's study, one is represented by the fauna of upper Ainoura formation and is characterized by the assemblage of typically Nishisonogian species, typically Shiratorigawan species and the species peculiar to the formation; while another represented by the faunas of Fukui and Kase formations is nearly wholly occupied by the second type species (MIZUNO, 1963, 1964).

Thus, it is highly probable that the upper part of Saseboan stage corresponds to the Shiratorigawan stage and the lower part of the former represents a peculiar faunal horizon situated between the Nishisonogian and Shiratorigawan, corresponding to the lowest unnamed stage of AOKI (1960). This transitional horizon was once called the Ainouran stage by SHUTO (1964), discriminated from MIZUNO's Saseboan stage.

The Nojima group lying on the Sasebo group is probably correlated with the Mabechigawan stage from a stratigraphical viewpoint, although there is no paleontological evidence. This view may be supported by a geohistorical feature. A larger part of the Japanese Islands area is considered to have suffered from the maximum transgression in the later half of the Shiratorigawan age, represented by the Onnagawa formation of the northeastern Japan, while from upheaving which increased towards Pliocene at the early Mabechigawan age. In the Sasebo coal field, the Kase formation situated at the uppermost horizon of Sasebo group exhibits exclusively a marine facies, showing the maximum transgression in the field; on the contrary, the lower part of the Nojima group comprising fresh-water molluscan fossils clearly shows a regressive and upheaving movements. These features seem to well agree with the general tendency cited above.

The chronological situation of both the Sasebo and Nojima groups is more or less problematic. Provisionally they are designated to early-middle Miocene and late Miocene respectively.

III. Characteristics of the Neogene fresh-water fauna in the Sasebo coal field

The fresh-water fauna mainly represented by many unionids as shown in that of the lower part of Nojima group is known from some other areas of Japan.

At Hirashima, the northeastern extremity of the Goto Islands, *Lamprotula nojimensis*, *L.*? sp., *Cuneopsis* sp., *Hyriopsis matsurensis* and *Bellamyia kosasana* were reported from the strata probably correlated with the lower part of Nojima group (SAKAGUCHI, 1961; MIZUNO, 1963). Also, from Narushima, central part of the Islands, the following six species were recently found by NAGAHAMA and MIZUNO (1965): *Lepidodesma uejii*, *L. japonica*, *Lamprotula uejii*, *L.* sp., *Unio* sp. and *Bellamyia kosasana*. Based upon the faunal similarity and resemblance of lithofacies between Narushima and Nojima, they concluded that the strata developed there are correlated with a part of the Oya formation, and also they inferred a large fresh-water basin developed widely through the Goto Islands and Sasebo coal field, at least during the early Nojima time. It is noteworthy that the fresh-water faunas found in the two districts are very similar with each other in generic and also in specific constituents.

On the other hand, the similar fauna was also reported from the lowest part of Koura formation on the coast of the Sea of Japan near the lake Shinji-ko, the western Honshu. According to SUZUKI (1949), the fauna comprises the following species.

Bellamyia kosasana (UEJI)
Semisulcospira sakamotoi SUZUKI (MS.)
S. kumotuensis SUZUKI (MS.)
Cristaria muroii etomoensis SUZUKI (MS.)
Parreysia nipponensis SUZUKI (MS.)
Lamprotula sakaii SUZUKI (MS.)
L. simanensis SUZUKI (MS.)
Hyriopsis oyamai SUZUKI (MS.)
Cuneopsis nipponensis SUZUKI (MS.)
C. nipponensis kourensis SUZUKI (MS.)
Corbicula sakaii SUZUKI (MS.)

It is very sorry that whether the difference of species between Nojima and Koura is essential or not is quite unknown, as SUZUKI's many new species have not been published until today, but the large similarity of generic assemblage in both the districts is very noticeable. The Koura formation has been generally considered to be early or middle Miocene so far. However, both the generic assemblage above-cited and the faunal occurrence, shown in TAI (1952), are very similar to those of Nojima. This may suggest that at least the lowest part of Koura comprising the fresh-water fauna belongs to a higher horizon, namely the Mabechigawan stage of upper Miocene.

The fresh-water fauna composed of the generic assemblage as accounted here is characteristic in the Tertiary and Quaternary of the Chinese continent, as pointed out already by SUZUKI (1949). LEROY (1940) described that *Lamprotula* is always associated by *Cuneopsis* in either fossil or modern association, from his study on the late Cenozoic unionids of the Chinese continent, and also he proposed "Lamprotulinae" from taxonomical viewpoint. This pattern of association is also true in the Japanese Miocene fauna, but is not quite found in the Pliocene and Quaternary faunas of the country.

According to LEROY (1940), in the continent the association first appeared during late Miocene in Mongol and flourished toward Quaternary, removing its northern limit of distribution southwards with the lapse of time. The removing of northern limit seems to have owed largely to decreasing of temperature in northern areas. This may be closely related with disappearance of the fauna from the Japanese Islands area since Pliocene. The disappearance of the fauna seems to have owed also to a breaking of land connection between the continent and the Islands in early Pliocene, which was kept during late Miocene and early - ? middle Miocene. This breaking is evidenced by the Pliocene marine faunas of some formations scattered on the western coastal provinces of the Sea of Japan.

Also, LEROY clarified that the complicated ornaments of *Lamprotula*—nodules, strong knobs, fine veinlets, coarse undulations etc.—appeared since late Pliocene in the continent. While, his view on this matter can not be adopted to the Japanese *Lamprotula*. *Lamprotula* with the complicated ornaments is clearly recognized in the Nojima fauna, as shown by *L. nagahamai* n. sp. and *L. divaricata* n. sp. Moreover, in Japan, the "lamprotulinid association" was already living during early-middle Miocene, as evidenced by the fauna of the Sasebo group, but it was rather poor and *Lamprotula* was only represented by that with smooth surface, *L. nojimensis*.

In summary, the fresh-water molluscan fauna mainly represented by that of the lower part of upper Miocene Nojima group is very similar to the late Cenozoic non-marine faunas in Chinese continent, but the fauna very predominant in the "Lamprotulinae" including *Lamprotula* and *Cuneopsis* seems to have appeared earlier (early Miocene), which obtained

complicated ornaments also earlier (late Miocene) in Japan than in the continent. The lamprotulinid fauna already disappeared from the area since Pliocene, probably largely owing to the decrease of temperature and disappearance of land connection with the continent in early Pliocene.

IV. Description of new species

The following seven new species of Unionidae are here described.

Genus *Lamprotula* SIMPSON, 1900

Lamprotula uejii n. sp.

Lamprotula nagahamai n. sp.

Lamprotula divaricata n. sp.

Genus *Cuneopsis* SIMPSON, 1900

Cuneopsis nagahamai n. sp.

Cuneopsis praeambiguus n. sp.

Cuneopsis pseudobarbouri n. sp.

Genus *Lepidodesma* SIMPSON, 1896

Lepidodesma japonica n. sp.

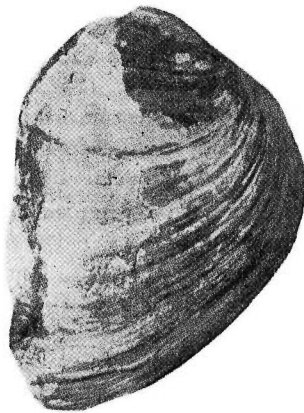
Lamprotula uejii n. sp.

(text-fig. 1; pl. 2, figs. 4, 4a, 5, 6)

1965. *Lamprotula uejii* MIZUNO (MS.)—NAGAHAMA and MIZUNO, *Jour. Geol. Soc. Japan*, vol. 71, no. 836, p. 232, pl. 1, figs. 7–11.

Materials. GSJ. 5265 (holotype) and GSJ. 5266.

Description. Shell medium in size, rather heavy, moderately inflated, suboval. Umbo inflated, prososyrate, situated at anterior upper part. Postero-dorsal margin obliquely arcuated; the antero-dorsal very short, rather abruptly turned to anterior end which gradually



Text-fig. 1 *Lamprotula uejii* n. sp.

Paratype, $\times 1$, right valve, GSJ. 5266; from Oya coasts (Oya formation).

pass to broadly arched, anteriorly ascending ventral margin; the ventral slightly sinuous at posterior part; posterior end rounded, curved to right. Posterior keel distinct, stronger

in right valve. Surface of shell ornamented only with concentric growth lines, except very faint rippled sculpture recognizable on postero-dorsal part. Dimensions of holotype: length, 52mm; height, 42mm; inflation, about 23mm.

Remarks. Besides the two specimens cited above, several ill-preserved shells from Narushima of Goto Islands were examined. The new species is somewhat similar to *Lamprotula nojimensis* UEJI (1934a, p. 284, text-figs. 1-8), but the former is higher, with more narrowly inflated and more prosogyrous umbo. The cited species is somewhat variable in shape according to UEJI (1934a)'s illustration and its shorter form is more akin to the new species, but from the former *L. uejii* is easily distinguished in having more broadly rounded posterior margin. Also, the short form of *Lamprotula antiqua* var. *undulata* ODHNER (1925, p. 15, fig. 14) and *L. antiqua* ODHNER (1925, p. 13, figs. 30-33) is somewhat similar to the new species in shape, but they have no distinct posterior keel. Another similar form, *Lamprotula pararochechouarti* LEROY (1940, p. 417, fig. 11) is distinguished from the new species in having strong nodes on shell surface.

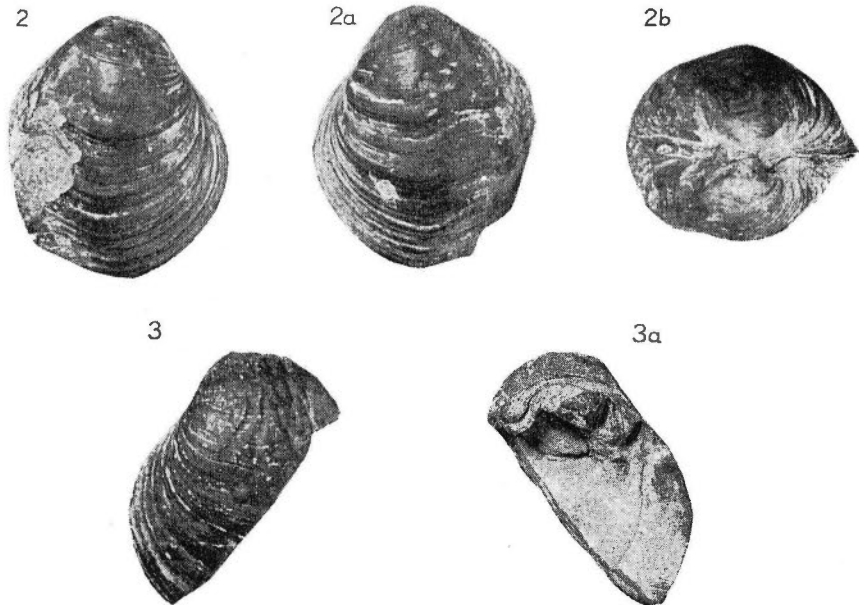
Occurrence. Oya coasts, Shikamachi, Kitamatsuura-gun, Nagasaki-ken; from the Oya formation (type locality).

Distribution in other district. Narushima, Goto Islands; from the probable correlative with the Oya formation (NAGAHAMA and MIZUNO, 1965).

***Lamprotula nagahamai* n. sp.**

(text-figs. 2, 2a, b, 3, 3a; pl. 1, figs. 6, 6a; pl. 2, figs. 1, 1a, b, 2, 2a, 3, 3a)

Materials. GSJ. 5257 (holotype), GSJ. 5252-5256, 5258 and 5259.



Text-figs. 2, 2a, b, 3, 3a. *Lamprotula nagahamai* n. sp.
Paratype $\times 1$, from Oya coasts (Oya formation). 2, 2a, b; GSJ. 5259: 3, 3a; GSJ. 5254.

Description. Shell very heavy, well inflated, round-trigonal to obliquely oval-trigonal, variable in shape. Umbo prominent, incurved, pointed, slightly prosogyrate. Anterior end broadly rounded, gradually connected from obliquely arched antero-dorsal margin; the postero-dorsal obliquely running in equal length or well elongated to form produced posterior end; ventral margin convex in general, tending to be roughly sinuated at central to posterior parts. Surface of shell ornamented with indented fine concentric growth lines and with very peculiar sculpture on the central to posterior parts of shell; the latter being represented by rather fine ripple-like oblique relief on dorsal part and the part behind posterior keel, tending to be coarser and more striking on the latter, but the former being shown by few somewhat wide radial ribs and furrows which are more or less rugated and give a serrate ventral margin in their lower ends. Hinge plate of left valve provides one large obliquely trigonal cardinal teeth and one narrow cardinal; posterior laterals fold behind the large cardinal and posteriorly elongated. Dimensions of holotype: length, 42mm; height, 43mm; inflation, 30mm.

Remarks. *Lamprotula nagahamai* n. sp. is very variable in shape. Roughly speaking, three forms are recognizable; one is represented by a round-trigonal form which is shown in the holotype (pl. 2, figs. 2, 2a) and some of the paratype (text-figs. 2, 2a, b), having subequilateral shell with short posterior end; the second is represented by a postero-ventrally elongated form as shown in pl. 2, figs. 1, 1a, b: and another exhibits the intermediate form of the two just mentioned; it is figured in pl. 1. The ornament of shell also varies, but the extent of variation seems to be not so wide. All the specimens are characterized by more or less ripple-like ornaments on the posterior-postero-dorsal part of shell and few longitudinal rises and furrows on the central to posterior surface and thus the pattern of ornaments is quite common throughout the specimens.

Lamprotula of such a type has been hitherto not recorded from any areas. *Lamprotula bieni* LEROY (1940, p. 421, fig. 14) seems to be somewhat similar to this new species, particularly to the last "intermediate form" mentioned above, but the former has not so sinuous shell. Also, *Lamprotula mongolica* LEROY (1940, p. 398, fig. 1) is rather similar to the present species, but it differs from the latter in having less inflated and less wide umbonal area. Certain type of the new species, showing in text-figs. 2, 2a,b, resembles *Unio graniferus* LEA (1835, p. 69, pl. 19, fig. 60) in the River Ohio near Cincinnati, but the latter has more prosogyrate umbo and less curved posterior hinge margin, and also resembles *Unio turgidus* LEA (1835, p. 11, pl. 5, fig. 11), but LEA's species has more quadrate form.

Occurrence. Oya coasts, Shikamachi, Kitamatsuura-gun, Nagasaki-ken; from the Oya formation (type locality).

***Lamprotula divaricata* n. sp.**

(pl. 1, figs. 7, 7a)

Material. GSJ. 5257 (holotype).

Description. Shell large, moderately inflated, suborbicularly quadrate, longer than high, with somewhat prominent umbo situated about at anterior one-third of shell. Postero-dorsal margin oblique, slightly convex, passing to rounded posterior margin with very obtuse angle; the antero-dorsal short, rather abruptly continued to subtruncated anterior end; posterior margin broadly arcuated, convex, slightly sinuous. Ornaments composed of concentric growth lines and remarkable divaricated rugated ribs; divarication line obliquely running on somewhat posterior part from umbo to posterior part of ventral margin; the ribs nodose; on the

anterior part from the line numbering about four, separated by wider valleys; on the posterior part, numbering about nine-ten and narrower, tending to diverge postero-ventrally. Posterior ridge ambiguous. Internal structure of shell unknown.

Remarks. The single specimen was examined. The present species is somewhat similar to the preceding new species, but has more rounded form with another pattern of surface sculpture. *Unio cornuum* LUNAE (HEUDE, 1881, pl. 57, fig. 105) is slightly similar to this species, but it has transversely more elongated shell with divarication line situated more posteriorly.

***Cuneopsis nagahamai* n. sp.**

(pl. 1, figs. 1, 1a, b, 2, 2a, b)

Materials. GSJ. 5260 (holotype), GSJ. 5262, 5264 and 5264'.

Description. Shell medium in size, heavy, moderately inflated, transversely elongated, lanceolate, with moderately prominent and inflated umbo which is situated very anteriorly. Antero-dorsal margin obliquely very short, turned to vertically subtruncated or slightly convex anterior margin; the postero-dorsal very long, obliquely broadly arcuated, convex, gradually passing to narrowly rounded posterior end; ventral margin laterally elongated, slightly sinuous, concave about at anterior two-fifths of shell. Posterior ridge well developed, obliquely arcuated. Surface of shell ornamented with indented numerous concentric growth lines and rippled small rises, the latter well developed dorsally above posterior ridge and also faintly on upper part of shell inside the ridge. Hinge part is not seen. Dimensions of holotype: length, 58mm; height, 25.5mm; inflation, 14.3mm.

Remarks. Three conjoined valves were collected from mudstone. The holotype specimen seems to be fairly corroded in umbonal part. The part is largely preserved in the figured paratype specimen, but the umbo is lost also from the latter. The paratype slightly differs from the holotype particularly in an inflation of shell; the former attains a larger inflation, about 21mm, in spite that it is probably nearly equal to the holotype in length. Nevertheless, both the specimens have very similar outline and ornaments, and they are surely conspecific.

The present new species is closely similar to *Nodularia pisciformis* YOKOYAMA (1932, p. 243, pl. 3, figs. 1, 2) in shape, but the latter has no ripple-like ornaments and is characterized by less sinuous ventral margin, subangulated postero-dorsal margin slightly concave posterior keel and more narrowly rounded posterior end. In these respects, both the species can be distinguished from each other. *Cuneopsis spocki* LEROY (1940, p. 402, fig. 4) is somewhat similar to the new species, too, but it has more widely rounded posterior end, slightly concave postero-dorsal margin and no rippled ornaments. From *Cuneopsis barboursi* KING reported by LEROY (1940, p. 424, fig. 15) the new species differs in having lower umbo and convex postero-dorsal margin, and from *Cuneopsis maximus* ODHNER (1925, p. 8, pl. 2, figs. 8-10) it differs in having remarkable ornaments of nodes.

Occurrence. Kurosaki, Kitamatsuura-gun, Nagasaki-ken; from the lower part of Fukazuki formation (Type locality).

***Cuneopsis praecambiguus* n. sp.**

(pl. 1, figs. 3, 3a, 3b; pl. 2, fig. 7)

Materials. GSJ. 5261 (holotype) and GSJ. 5263.

Description. Shell medium in size, heavy, inflated, transversely elongated, obliquely trigono-oval. Umbo situated anteriorly, incurved, inflated, pointed. Postero-dorsal margin ob-

liquely elongated, convex, continued to narrowly rounded and produced posterior end; anterior margin more broadly rounded; the ventral more or less bent inwards, broadly convex about at its central part, but concavely sinuous at posterior part. Posterior keel very distinct, obliquely narrow, somewhat convex. Ornaments consist of concentric growth lines which tend to be more indented ventrally, of faint some nodes developed on dorsal and postero-dorsal surface and of faint one radial riblet running paralelly to posterior keel on postero-dorsal part of shell. Left valve provides one long and narrow lateral furrow; and two large, narrowly triangular two pseudo-cardinals. Dimensions of holotype: length; 46.5mm+ (broken in posterior part); height, 25.2mm; inflation (single valve), 17.5mm.

Remarks. Although the available specimens are broken in posterior part, the shell of the present species seems to be more or less quadrate in younger stage and produced postero-ventrally in older stage. The bending inwards of ventral part is very strong in the holotype, but rather gentle in the paratype. The new species is somewhat similar to the young shell of *Cuneopsis ambiguus* LEROY (1940, p. 418, fig. 12) in shape, but the latter is less inflated, having no sculpture of nodes. *Cuneopsis maximus* ODHNER (1925, p. 8, figs. 8-10) has more elongated shell and shorter anterior part than the present species.

Occurrence. Kurosaki, Kitamatsuura-gun, Nagasaki-ken; from the lower part of Fukazuki formation (type locality).

***Cuneopsis pseudobarbouri* n. sp.**

(pl. 1, fig. 4, ? fig. 5)

Materials. GSJ. 5341 (holotype, inner mould of left valve), GSJ. 5270 and 5273-5277.

Description. Shell medium in size, rather compressed, transversely elongated, somewhat lanceolate. Umbo situated anteriorly, high, slightly inflated. Anterior end vertically subtruncated or faintly arched; the posterior produced, narrowly rounded; ventral margin broadly arched, convex as a whole, but tends to be faintly concave about at central portion. Posterior ridge obliquely running behind umbo to postero-ventral corner, somewhat convex dorsally and concave ventrally. Surface of shell sculptured with concentric growth lines, except one very narrow radial striae developed between postero-dorsal margin and posterior ridge. Internal structure of shell is unknown. Dimensions of holotype: length, 55mm; height, 30mm.

Remarks. Poorly preserved two specimens were examined. The new species is somewhat akin to *Cuneopsis barbouri* KING reported by RELOY (1940, p. 424, fig. 15), but the latter has more sinuous ventral margin and posterior ridge very close to hinge line. From *Cuneopsis nagahamai* n. sp., the present new species differs in having the posterior keel more distant from hinge margin and weaker ventral sinuation situated at central portion of shell. *Unio Corderii* HEUDE (1875, pl. 1, fig. 3) has rather similar form to the new species, but it is characterized by lower umbo.

Some other specimens doubtly identified to the new species are at hand, too (GSJ. 5273-5277). They have more anteriorly situated umbo, more elongated postero-dorsal margin and more convex ventral margin. Thus they may possibly represent another new species of the genus. But here they are provisionally included in *C. pseudobarbouri*.

Occurrence. Yoshinotani, Sasamachi, Kitamatsuura-gun, Nagasaki-ken; from the upper horizon of middle part of Ainoura formation (type locality): Sasa Colliery; from the Ainoura formation (doubtful specimens).

Lepidodesma japonica n. sp.

(text-fig. 4; pl. 2, fig. 8)

1965. *Lepidodesma japonica* MIZUNO (MS.)—NAGAHAMA and MIZUNO, *Jour. Geol. Soc. Japan*, vol. 71, no. 836, p. 232, pl. 1, figs. 14, 15.

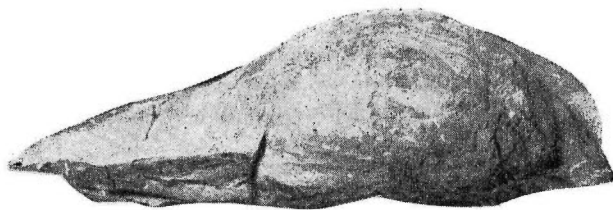
Materials. GSJ. 5267 (left valve of holotype) and 5268 (right valve of holotype).

Description. Shell very large, moderately inflated, ovably trigonal, rather thin. Umbo prominent, inflated, prosogyrate, situated at anterior one-fourth. Postero-dorsal margin obliquely arcuated, long, convex, gradually passing to rather narrowly rounded posterior end, the antero-dorsal short, anteriorly oblique; anterior end and ventral margin uncertain on account of deformation, but the former seems to be narrowly rounded and the latter broadly arched. Posterior wing not preserved, but it seems to be short and low behind beak, considering from its trace. Posterior ridge very faint, obliquely running behind beak to postero-ventral corner. Surface of shell sculptured with many concentric growth rises, represented by very feeble narrow riblets at posterior part and by those of rather strong and narrow at anterior-central part. Ligament very long. Lateral teeth of left valve two, very long, narrow. Dimensions of holotype: length, about 142mm; height, about 90mm (estimated).

Remarks. One conjoined valve which is more or less worn out was obtained from dark grey mudstone. It is strongly deformed particularly in antero-ventral part. In outline of shell the new species is very similar to *Lepidodesma septentrionale* SUZUKI (1942, p. 154, pl. 2, figs. 2a,b) from the Paleogene of northern Japan and Sakhalin, but the latter has more inflated shell sculptured with very prominent concentric ribs, which are not quite visible in the former. Another similar form is *Lepidodesma langulati* (HEUDE), 1874, but it has somewhat lower shell with posteriorly situated umbo, characterized by more coarsely arranged concentric ribs than the former. From *Lepidodesma uejii* KURODA (1940, p. 64) for *Anodonta*? sp. of UEJI (1934b) the new species is clearly distinguished in having less inflated shell with more prosogyrate umbo and finer ornamentation. *Lepidodesma*? sp. of UEJI (1934b, p. 343, pl. 6, fig. 8) appears to be related to the new species, but the ill-preservation of the former rejects the identification of them.

Occurrence. Oya coasts, Shikamachi, Kitamatsuura-gun, Nagasaki-ken; from Oya formation (type locality).

Distribution in other district. Narushima, Goto Islands; from the probable correlative of Oya formation (NAGAHAMA and MIZUNO, 1965).



Text-fig. 4 *Lepidodesma japonica* n. sp.

Holotype, $\times 0.5$, dorsal view of left valve, GSJ. 5267; from Oya coasts (Oya formation).

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佐世保炭田産の中新世カワシンジユガイ科の新種について

水野 篤行

要 旨

地質調査所に保存されている佐世保層群、および野島層群産の淡水貝化石を検討したところ、*Lepidodesma*, *Lamprotula*, *Cuneopsis* に属する 7 新種が発見された。これらは次のとおりである。

Lamprotula uejii n. sp.

Lamprotula nagahamai n. sp.

Lamprotula divaricata n. sp.

Cuneopsis nagahamai n. sp.

Cuneopsis praeambiguus n. sp.

Cuneopsis pseudobarbouri n. sp.

Lepidodesma japonica n. sp.

本論文ではこれらを記載したほか、佐世保・野島両層群にふくまれる淡水貝化石群の産状をのべ、またその性格について若干の議論を行なった。

主として野島層群の下部のものによって代表される淡水貝化石群は *Lamprotula*, *Cuneopsis*, *Lepidodesma*, *Bellamyia* などによって特徴づけられる。

この化石群は以前から指摘されているように中国大陸の新生代および現生の淡水貝類群にきわめて類似した構成をもっている。大陸地域では“*Lamprotulinae*”の動物群は中新世後期に出現し、現在におよんでいるが、日本列島地域（その西部）ではそれは中新世初期から出現し（佐世保層群相浦層にふくまれている）中新世後期におよんだが、鮮新世以降にはまったく消失した。この消失はおそらく、鮮新世における温度低下と、日本列島・中国大陸間の陸地の連絡がとぎれたことによると思われる。

PLATES
AND
EXPLANATIONS

(with 2 Plates)

Explanation of plate 1

Figs. 1, 1a, b, 2, 2a, b. *Cuneopsis nagahamai* n. sp.

Figs. 1, 1a, b. holotype, $\times 1.2$. GSJ. 5260: 1, left valve; 1a, dorsal view; 1b, right valve.

Figs. 2, 2a, b. paratype, $\times 1.2$. GSJ. 5262: 2, left valve; 2a, dorsal view; 2b, right valve.

Both the specimens came from Kurosaki (Fukazuki formation).

Figs. 3, 3a, b. *Cuneopsis praeambiguus* n. sp.

holotype, $\times 1.1$. GSJ. 5261. 3, left valve; 3a, internal view; 3b, dorsal view. Loc. Kurosaki (Fukazuki formation).

Figs. 4,?5. *Cuneopsis pseudobarbouri* n. sp.

Fig. 4. inner mould of left valve, holotype, $\times 0.95$. GSJ. 5341. Loc. Yoshinoura (Ainoura formation).

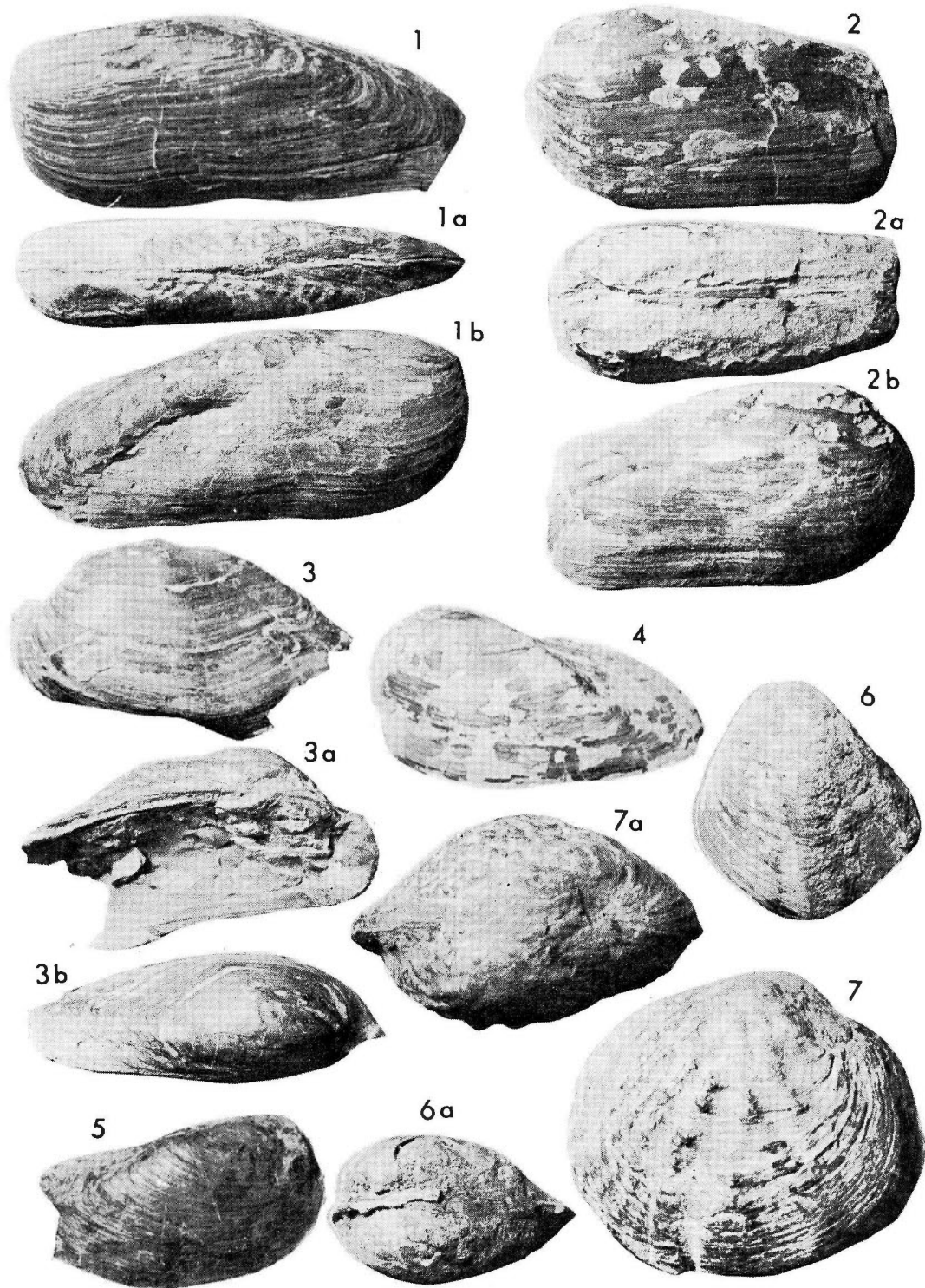
Fig. 5. inner mould of left valve, doubtly identified specimen, $\times 0.9$. GSJ. 5273. Loc. Sasa colliery. (Ainoura formation).

Figs. 6, 6a. *Lamprotula nagahamai* n. sp.

paratype, $\times 0.9$, left valve. GSJ. 5253. 6a, dorsal view. Loc. Oya coasts (Oya formation).

Figs. 7, 7a. *Lamprotula divaricata* n. sp.

holotype, $\times 0.8$. GSJ. 5251. 7, right valve; 7a, dorsal view. Loc. Oya coasts (Oya formation).



Explanation of plate 2

Figs. 1, 1a, b, 2, 2a, 3, 3a. *Lamprotula nagahamai* n. sp.

Figs. 1, 1a, b. paratype, $\times 1$. GSJ. 5252: 1, left valve; 1a, dorsal view; 1b, right valve.

Figs. 2, 2a. holotype, $\times 1$. GSJ. 5257: 2, right valve; 2a, dorsal view.

Figs. 3, 3a. paratype, $\times 1$. GSJ. 5258: 3, inner mould of left valve; 3a, dorsal view of inner mould.

All the specimens came from the Oya coasts (Oya formation).

Figs. 4, 4a, 5, 6. *Lamprotula uejii* n. sp.

Figs. 4, 4a. holotype, $\times 1$. GSJ. 5265: 4, left valve; 4a, dorsal view. Loc. Oya coasts (Oya formation).

Fig. 5. paratype, $\times 1$. GSJ. 5348, model of hinge part of left valve. Loc. Narushima, Goto Islands.

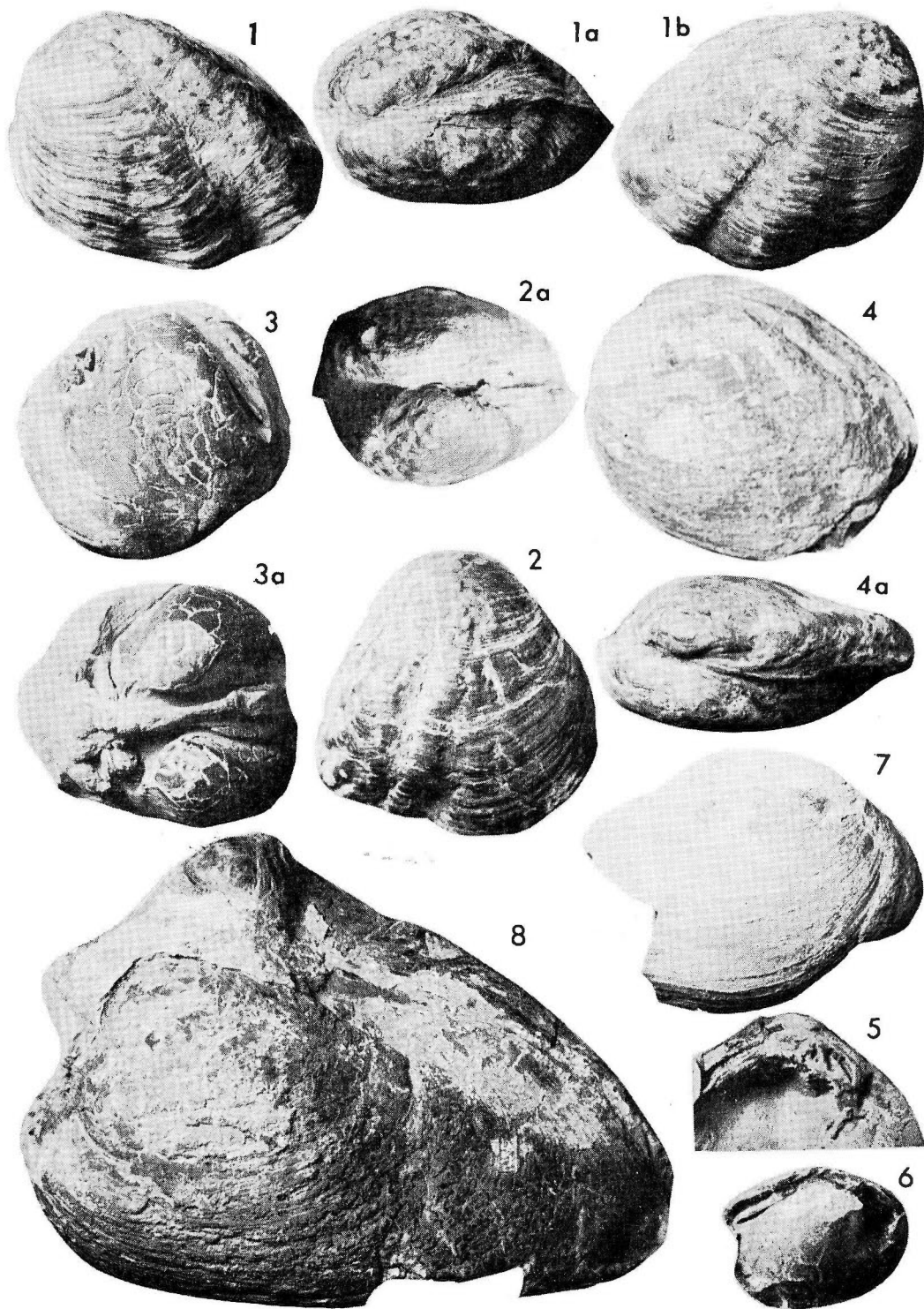
Fig. 6. paratype, $\times 0.9$. GSJ. 5349, inner mould of right valve. Loc. as above.

Fig. 7. *Cuneopsis praeambiguus* n. sp.

paratype, $\times 1.2$, right valve. GSJ. 5263. Loc. Kurosaki (Fukazuki formation).

Fig. 8. *Lepidodesma japonica* n. sp.

holotype, $\times 0.7$, left valve, very deformed in antero-ventral part, GSJ. 5267 and apical part of right valve, GSJ. 5268. Loc. Oya coasts (Oya formation).



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- B. 応用地質に関するもの
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Mizuno, A.

On the New Miocene Unionids from the Sasebo Coal Field, Western Japan

Atsuyuki, Mizuno

地質調査所報告, No. 215, p. 1~13, 1966

2 pl., 1 tab., 4 Text-figs.

Among the collection of fossils in the Geological Survey of Japan, the writer found seven new species of fresh-water pelecypod fossils which occurred from the Miocene Sasebo and Nojima groups in the Sasebo coal field. They are: *Lamprotula uejii* n. sp., *L. nagahamai* n. sp., *L. divaricata* n. sp., *Cuneopsis nagahamai* n. sp., *C. praeambiguus* n. sp., *C. pseudobarbouri* n. sp. and *Lepidodesma Japonica* n. sp. In this paper, the new species are taxonomically described and faunal occurrences in both the groups are accounted, together with some discussions on the paleontologic problem concerning the fauna.

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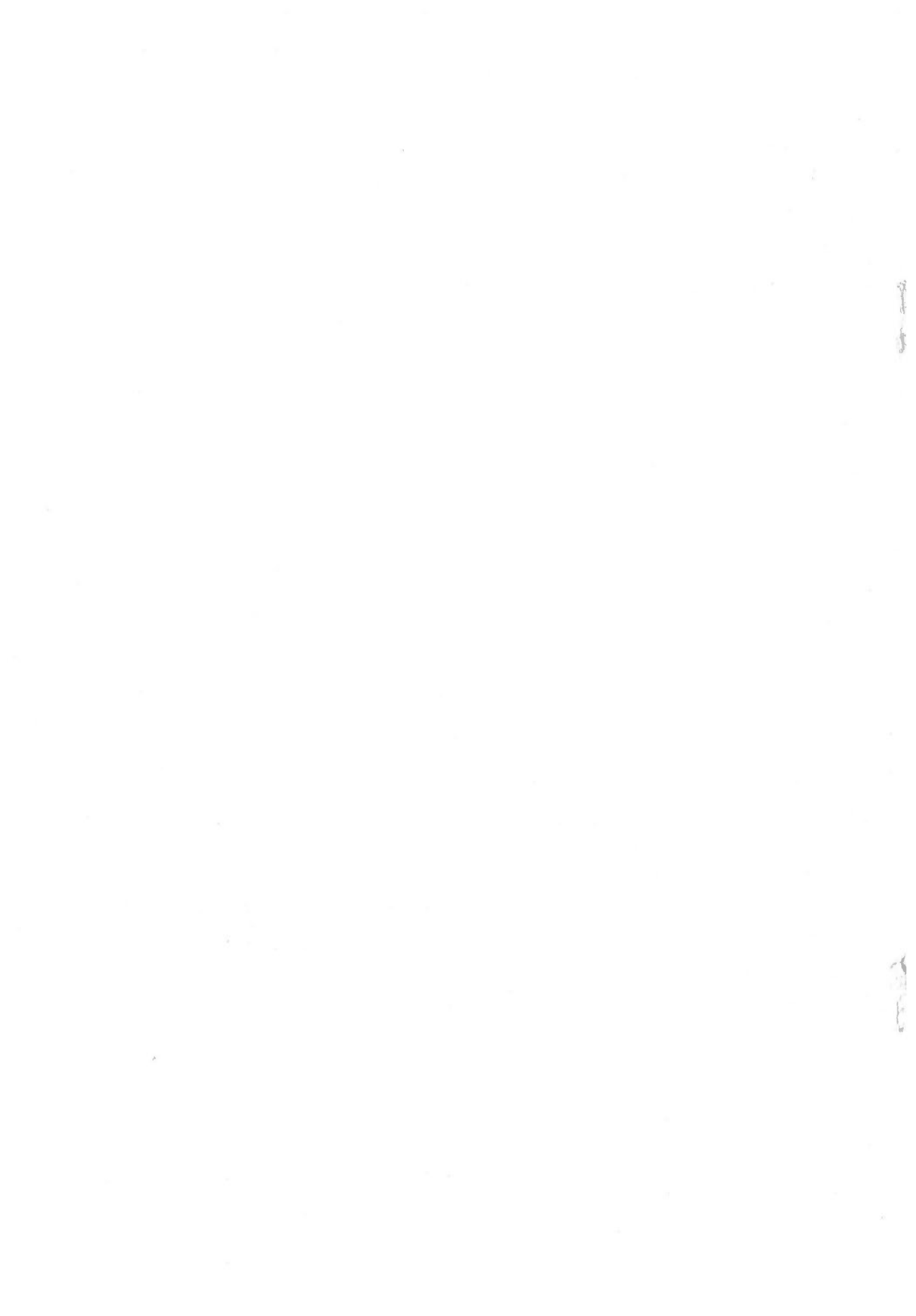
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