

A Study on the Pelecypod-Fauna of the Upper Triassic Nabae
Group in the Northern Part of Kyoto Prefecture, Japan.
Part 2 Bakevelliids (with Appendix to Part 1)

By

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Abstract

The genus *Bakevellia* is one of the most important fossil-pelecypods of the Upper Triassic Nabae group as well as of the Lower and Middle Triassic Inai Series in the "Maizuru zone". Seven species of *Bakevellia* are described below, among which four are new species and two are indeterminable.

Preface and Acknowledgement

The so-called "Gervillias" are found to be more abundant in the "Maizuru zone" than any other district in Japan of the entire Triassic Period. Those of the Upper Triassic group are referred to the genus *Bakevellia* KING, 1848 em. Cox, 1940 (pp. 105-8), and are divisible into three groups mainly by dentitions. The first group, including *B. matsushitai* and *B. cf. matsushitai*, is considered as a typical *Bakevellia* s. s. in *Pteria*-like outline and in dentition consisting of one or two short cardinal teeth and one or two subhorizontal laterals. The second group, including *B. oyogiensis* and *B. monobensis*, is also *Pteria*-like in outline, but differs from the former in short but broad, vertically serrated, cardinal teeth and sockets, which are often differentiated into a series of small denticles. The third group, including *B. hekiensis*, *B. subhekiensis* and *B. sp. indet.*, is rather different from the preceding two groups in subquadrate outline with an undeveloped anterior auricle and in dentition consisting of pseudotaxodont denticles and subhorizontal lateral teeth. The last group may be separated subgenetically from *Bakevellia* s. s., but in this paper the writer placed in the genus, until he will discuss the Lower and Middle Triassic Bakevelliids together with the Upper ones in the near future.

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Universite de Strasbourg for kindly sending the copy of her original descriptions about *Pseudogervillia*; to Dr. L. R. COX of British Museum, Prof. T. MATSUMOTO of Kyushu University and Assist. Prof. K. ICHIKAWA of Osaka City University for their kind and helpful suggestions; to Prof. T. KOBAYASHI of Tokyo University for his courtesy in making his valuable books accessible. His thanks are also due to Mr. F. KATO for his help in photography.

Description of Species

FAMILY ISOGNOMONIDAE

Genus *Bakevellia* KING, 1848, em. COX, 1940

References: KING (1848), A Catalogue of the Organic Remains of the Permian Rocks of Northumberland and Durham, P. 10.

COX, L. R. (1940), The Jurassic Lamellibranch Fauna of Kucch, Pal. Indica, ser. 9, vol. 3, pt. 3.

Type: *Avicula antiqua* MUNSTER (in Goldfuss, 1836, p. 126, Pl. CXVI, Fig. 7)

Bakevellia matsushitai sp. nov.

Pl. III, Figs. 1-5, 8.

Description:—Shell comparatively large, but rather thin, slightly inequivalve, very inequilateral, *Pteria*-like in outline, longer than high. The left valve more convex than the right; one of the paratype specimens (Pl. III, Fig. 8), though inflated by secondary deformation, 13 mm deep in the internal mould of the left and 8 mm in the right. Umbo slightly salient, situated very anteriorly at about one fifth of the hinge-length from the frontal extremity. Anterior auricle small, depressed, slightly convex, well defined from the rest; posterior auricle large, wing-like in shape, protruded backward with arcuate posterior margin, and gradually flattened posteriorly from the main body. Ligament-area narrow, long, nearly parallel sided, but tapering backward near the posterior end, and striated transversely; ligament-pits three to five, usually four in number, trapezoidal or quadrangular in outline, the first pit situated just beneath the umbo. Two cardinal teeth in the left valve and one in the right, small, rudimentary and somewhat irregular in outline, among which the posterior cardinal tooth of the left valve almost obscure, the cardinal tooth of the right valve sometimes serrated slightly by one or two weak furrows and anterior cardinal socket bordered anteriorly by more or less tooth-like ridge; one (or two?) lateral tooth and a socket of each valve, long, linear, nearly parallel with the hinge-margin, running backward from the last ligament-pit. Adductors perhaps anisomyarian, posterior adductor scar not observed, anterior one small but deep, irregular in shape lying on the anterior side of the umbonal cavity; a slender, deep pedal retractor impression being behind the anterior scar and near the top of the umbonal cavity. Pallial line entire, consisting

of a series of small distinct impressions, but gradually inconspicuous towards ventral side. Surface ornamented with close-set, regular growth-lines (Pl. III, Fig. 5).

Remarks; — There are two small specimens associated with large ones just described, which are considered as immature individuals by their shape and ornamentation. They differ from the adult, in smaller number of the ligament-pits (i. e. two), and in the oblique, triangular outline of the same and also in the distinct and radially arranged cardinal tooth and sockets (Pl. III, Figs. 1-3). They have much alliance with primitive *Bakevellias*, such as the Permian *B. antiqua* MUNST. and *ceratophaga* SCHLOTH. (GOLDFUSS, 1834-40; KING, 1850; GEINITZ, 1861), and the Lower Triassic *B. costata* SCHLOTHEIM (GREDNER, 1851; HOHENSTEIN, 1913), *B. goldfussi* v. STROMBECK (SCHAUROTH, 1857; FRANTZEN, 1880). These changes in growth, as observed also in "*Gervillia*" *aliformis* (SOWERBY) by WOODS (1905, p. 71, Pl. 9, figs. 9-11. Text-figs. 9-14), are interesting in the consideration of phylogenetical relations. The adult specimens resemble "*Gervillia*" *shaniorum* HEALEY (1908, pp. 16-18, Pl. II, Figs. 1-9) from the Rhaetic Napeng beds of Burma in shape and ornamentation, but is readily distinguished by the dentition and more developed anterior auricle. They also similar to "*G.*" *bouei* HAUER (FRECH, 1902, p. 617, Text-figs.) and "*G.*" *bouei* var. *obliqua* BITTNER (1901, p. 30, Pl. 5, Figs. 7, 8; KOKEN, 1913, p. 28, Pl. 3, Fig. 8), but differs from them in larger anterior auricle and in having a distinct lateral tooth.

Locality and Horizon:— All specimens were obtained from sandy shale bed in the middle part of the N₂ beds; common at Kongoin, Maizuru City (Loc. Nos. N-102, 103), very rare at Miuchi and Shinmichi, Ayabe City (Loc. Nos. N-402, 409), and Nabae (N-201), Uchiura-mura. (Reg. Nos. JM 10060-10067.)

Bakevellia cf. *matsushitai*

Pl. III, Figs. 6, 7.

There are some specimens with thick and large valves, which resemble closely the preceding species in outline and ornamentation, and some of them are accompanied by the latter. They differ from *matsushitai* in broader ligament-area, larger number of higher ligament-pits of indefinite breadth, and in more degenerated cardinal teeth, in some case almost absent (Pl. III, Fig. 7). E. W. Benecke (1905, p. 126) studied the variability between the thick - and thin - shelled specimens of *Gevillia* (= *Aguileria*) *hartmanni* GOLDFUSS. Above mentioned specimens, also, may be mere varietal forms of *B. matsushitai* caused by thick shell, but cannot be identified until more complete and a larger number of samples will be obtained.

There is an internal mould of the right valve provided with a comparatively short lateral tooth and socket and hardly recognizable cardinals, but traces of two cardinal sockets, posterior and anterior, can be seen respectively on the first ligament-pit and on the ligament-area in front of the pit and besides, they converge

upward (Pl. III, Fig. 6). This fact is assumed to indicate that the specimen had once a radially arranged cardinal hinge in young stage. This species resembles more closely "*G.*" *bouei* than does *B. matsushitai*.

Occurrence and Horizon:—The specimens are confined to the N_2 beds. Most of them were obtained from the sandy shale bed of the middle part of the N_2 beds at Kongoin (Loc. Nos. N-102, 103), associated with *B. matsushitai* and others. (Reg. Nos. JM 10068-10073.)

***Bakevellia oyogiensis* sp. nov.**

Pl. III, Fig. 9, Pl. IV, Figs. 1-4.

cfr. "*Gervillia*" *sachii*, KOBAYASHI and ICHIKAWA, 1952, p. 75,
Pl. II, Figs. 3a-c

Description:—Shell of medium size, sometimes fairly large, inequivalve, very inequilateral, much longer than high. Umbo small, slightly salient above hinge-margin, located at about one-fourth of the hinge-length from the anterior end. Anterior auricle comparatively large, pointed, inflated at medial portion, defined from the rest of the valve by a shallow and narrow depression; posterior auricle larger, somewhat suddenly depressed from the umbonal slope, arcuate and long protruded backward with a narrow, weak ridge and furrow along dorsal margin (Pl. IV, Fig. 1). Valves moderately convex, stronger in the left than the right, attaining 9 mm and 7.5 mm in depth respectively, measured by the bivalved internal mould of the holotype (Pl. IV, Fig. 3a). Anterior margin making an acute angle (about 50°) with the hinge-line, slightly sinuous near the anterior extremity, gently curving posteriorly with antero-ventral sinuation, ventral margin broadly rounded, steeply ascending forward to posterior margin, then suddenly bent backward producing narrow long rostrum, which is not preserved usually in internal moulds. Surface ornamented with fine, close-set growth-lines like *B. matsushitai*. Hinge with a narrow ligament-area, tapering backward and forward, bearing two or three, broad, quadrangular ligament-pits, of which the first one usually provided with an upper margin slanting from and not coinciding with the upper margin of the area. Dentition consisting of one slender cardinal tooth and two laterals in the right valve, two cardinals and one or two laterals in the left. In the right valve of the holotype specimen, an anterior cardinal socket subtriangular and deep, bordered by a somewhat deticle-like anterior margin, and a posterior cardinal socket, shallower, broader, somewhat irregular in outline, with three weak vertical ridges in it, and comparatively slender cardinal tooth also serrated (Pl. IV, Figs. 3a, b); in addition, a few, very weak, oblique crenulation seen at the lower margin of the ligament-area between the first and second pits. The first lateral tooth of each valve long, strong and subparallel with the hinge-margin, the second one rudimentary and sometimes absent in the left valve.

Musculature as in *B. matsushitai*.

Remarks and Comparison:— In a small bivalved one of the paratype specimens (Reg. No. JM 10082), the first ligament-pit is subtrigonal in shape, and cardinal hinge is somewhat radially arranged, and serration cannot be confirmed by unfavourable preservation.

This species closely resembles *B. matsushitai*, and "*Gervillia*" *praecursor* QUENST. in HEALEY (1904, pp. 18–20, Pl. III, Figs. 2–14) in shape and ornamentation, but differs from *matsushitai* in more oblique outline, slender ligament-area, smaller number of ligament-pits, especially in the distinctly serrated cardinal teeth and ridged cardinal sockets, and differs from *praecursor* in more equivalved shell, thicker ligament-area, and smaller number of broader ligament-pits. This species is more allied to "*Gervillia*" *shaniorum* HEALEY in dentition, but differs in the more developed anterior auricle and almost undeveloped crenulation behind cardinal teeth. "*Gervillia*" *saekii* KOBAYASHI and ICHIKAWA (1952a, P. 75, Pl. II, Figs. 3a–c, 1952b, p. 267, Pl. X, Figs. 9, 10) seems rather different from this species at first glance, but the latter is strongly deformed and is considered differing very much from its original, which is supposed to be most closely allied to, or conspecific to *oyogiensis* or *matsushitai*. This problem will remain unsolved, until topotype specimens of *saekii* will be obtained and the hinge-structure studied.

Occurrence and Horizon:— Rare from the middle part of the N_2 beds at Kongoin (Loc. No. N-102), common from the lower part of the N_3 beds at Terada, Maizuru City, and nearly equal horizon at Miuchi (N-414) and Shinmichi (N-404), Ayabe City. (Reg. Nos. JM 10076–10088).

***Bakevellia monobensis* sp. nov.**

Pl. IV, Figs. 5–9, Pl. V, Figs. 1a–d, 2.

Descriptions:— Shell thin, small in size, perhaps inequivalve, very inequilateral, *Pteria*-like in outline like *B. matsushitai* and *B. oyogiensis*, longer than high. Umbo not prominent, rather slender, situated at about one-fourth to fifth of the hinge-length and a little salient above hinge-margin. Anterior auricle comparatively large, depressed, slightly inflated, pointed forward making an acute angle with the hinge-margin, and sharply defined from the rest, where a slight antero-ventral sinuation is observed; posterior auricle larger, wing-like in shape, nearly flat, sometimes, even concave, protruded backward, and fairly sinuated below. Surface ornamented with regularly spaced, slightly lamellose concentric striae, coarser on the body than auricles. Ligament-area very slender, trigonal in outline, bearing three, shallow, trigonal ligament-pits which become weaker and more oblique posteriorly, and the last one not attaining to the upper periphery. Hinge consisting of two cardinal teeth and a lateral tooth in the left valve, one cardinal and one or two(?) laterals in the right; anterior cardinal tooth of the left valve, slender and directed downward and forward, posterior cardinal of the left and a

cardinal of the right are variable in shape and size as shown in figures (Pl. IV, Figs. 8a, b, 9b, Pl. V, Figs. 1a-d); in the holotype specimen (Pl. IV, Figs. 9a, b) posterior cardinal tooth striated vertically, and cardinal socket provided with small ridges like those of *B. oyogiensis*, but in another specimen irregular in shape (Pl. V, Fig. 1a) and in another one differentiated to several denticles (Pl. V, Figs. 1b, c). Anterior adductor scar and a pedal retractor impression placed on the anterior portion of the umbonal cavity, very small, posterior adductor scar not observed; pallial line recognizable only near the anterior scar, but perhaps entire (Pl. V, Fig. 2).

Comparison:—This species is closely related to *B. oyogiensis* in outline and dentition, but differs in much thinner valve, slender ligament-area, trigonal and weaker ligament-pits, and more distinct concentric sculpture. It also has some resemblance to *B. costata* v. SCHAULOTH in ornamentation, but readily distinguished from the latter by dentition. "*Gervillia*" *praecursor* QUENST. in HEALEY and "*G.*" cf. *praecursor* QUENST. in KRUMBECK (1914, p. 231, Pl. 16, Fig. 10) are other intimate species in appearance, but perhaps less inequivalve, and further comparison cannot be stated because of the lack of the description on their dentitions.

Occurrence and Horizon:—From the sandy shale of the lowest part of the N₃ beds at Monobe (Loc. No. N-601). (Reg. Nos. JM 10089-10093).

***Bakevella hekiensis* (KOBAYASHI and ICHIKAWA)**

Pl. V, Figs. 3-8, Pl. VI, Figs. 1-3

1952. "*Gervillia*" *hekiensis*, KOBAYASHI and ICHIKAWA, pp. 76-78,

Pl. II, Figs. 4-6.

Description:—As the species was described in detail by KOBAYASHI and ICHIKAWA, a supplementary description is added here. Shell thick, slightly inequivalve; the left is more convex than the right (Pl. V, Figs. 6a, b). Surface is nearly smooth except for weak, dense growth-lines which become stronger near the periphery, and sometimes a slight antero-ventral situation is seen in the young stage (Pl. V, Fig. 7).

A series of cardinal denticles is dwarfed or interrupted by the incision of ligament-pits and separated from each other (Pl. V, Figs. 3a, b, 4a, b). It is variable in number, generally increasing with growth; in smaller specimens 3-4 anterior cardinal denticles and in larger ones 5-7, and in still larger and thick-shelled specimens, the denticles degenerate and become obscure in some degree. The most anterior tooth of the left valve and a corresponding socket of the right distinctly larger than the rest, and considered as a cardinal tooth and socket respectively.

Observation and Remarks:—There is a small specimen in hand provided

with a few, radially arranged anterior denticles without posterior ones, and having a great resemblance to *B. subhekiensis* described below, which is considered as the ancestral species of *hekiensis* (Pl. V, Fig. 5). The writer thinks that it is not a varietal form, but that it maintains primitive, immature characters by chance. There are other two specimens of more slender and more oblique shells than usual (Pl. VI, Figs. 2, 3a, b). They have larger number of anterior denticles of irregular and different shapes, attaining 8 and 10 in number respectively, and are considered as varietal forms, but the writer hesitates to separate them decidedly as they are severely deformed and only two in number. Nevertheless, it is interesting that one of them (Pl. VI, Fig. 2) was obtained from the highest horizon of the locality of *hekiensis* at Shinmichi, and the other (Pl. VI, Figs. 3a, b) from the isolated locality.

Comparison :— The dentition of this species is considered as an intermediate type between those of *Bakevellia* s. s. and *Aguileria* WHITE, 1887 and reminds the writer of *Pseudogervillia* GILLET, 1922 (at first established as a section under *Gervillia* WAAGEN, and later included into *Bakavellia* by COX, 1940), but differs in shape, and in more numerous denticles, changing gradually into lateral teeth. It also reminds him of "*Gervillia*" *alberti* GOLDFUSS in CREDNER (1851, p. 654, Pl. 6, Fig. 7) and "*G.*" *mytiloides* SCHLOTH. in CREDNER (ditto, p. 652, Pl. 6, Fig. 6). But it differs from them in less developed anterior auricle and less oblique outline. Though it may be better to separate the species subgenetically from *Bakevellia* s. s., there is no doubt that *hekiensis* was derived from some species of *Bakevellia* s. s. through intermediate species such as *subhekiensis*, and is placed here in *Bakevellia* s. l..

Occurrence and Horizon :— From the sandy shale of the lowest part of the N₃ beds at Kichisaka? (Loc. No. N-121) and at Shinmichi (Loc. No. N-405, 407, 414), from shale and sandstone of the lower beds of the Heki formation at Heki (Loc. Nos. NH-701-705). (Reg. Nos. JM. 10094-10105).

***Bakevellia subhekiensis* sp. nov.**

Pl. VI, Figs. 4-7.

Description :— Shell small, thin, roundly subquadrate and much like *B. hekiensis* in outline, but usually more rounded at antero-dorsal extremity. Umbo located at about one-fourth of the hinge-length from the frontal extremity, slightly salient in the left valve, but not in the right. Ligament-area of low and wide triangular outline, provided with usually two ligament-pits which are somewhat variable in shape. Dentition much like those of *hekiensis*, but different in lacking usually posterior denticles.

Remarks and Comparison :— This is undoubtedly closely related to *B. hekiensis*, but is considered the more primitive form in the following points :

1. smaller and thinner shell
2. trigonal outline of the ligament-area
3. smaller number of ligament-pits
4. often subtrigonal ligament-pit
5. simpler dentition and more anteriorly directed cardinal tooth and socket.

One of the paratype specimens (Pl. VI, Fig. 4a, b) has a oblique, rudimental posterior denticle between the first and the second pits, showing a tendency to develop into the dentition of the *hekiensis* type: another paratype (Pl. VI, Fig. 6a, b) is hardly distinguishable from the juvenile of *hekiensis* (Pl. V, Fig. 5). These were obtained from sandy shale of the uppermost horizon of the N_1 beds, while those of *hekiensis* mostly from the lower part of the N_2 beds, rarely from the N_2 beds. All the data above stated indicate that *B. subhekiensis* is a direct ancestor of *B. hekiensis*. On the other hand, a juvenile specimen of the former (Pl. VI, Fig. 7) shows a dentition much like that of *Bakevillia* s. s. species such as Permian *B. antiqua* MUNSTER described by KING (1850, p. 128, Pl. 14. Fig. 34) or Lower Triassic *B. goldfussi* STROMB. described by SCHAUROTH (1857, p. 106, Pl. 5, Fig. 5) or Lower Triassic *B. okuyamaensis* NAKAZAWA MS. from the Maizuru zone, and it suggests that the species is derived from the primitive *Bakevillia* s. s. species.

Occurrence and Horizon:— From the sandy shale of the uppermost horizon of the N_1 beds at Nabae (Loc. No. N-220) Reg. Nos. JM. 10106-10110.

Bakevillia sp. indet.

Pl. VI. Fig. 5a- B.

There is an incomplete specimen associated with *B. subhekiensis* preserving a high ligament-area and a pit, and provided with numerous short denticles, which resemble those of *hekiensis*. It is so fragmentary that it cannot be decided whether it is a specialized form of *B. subhekiensis* or *B. hekiensis*, or a new species. But it is noteworthy that such a specialized individual has been discovered associated with *subhekiensis*. (Reg. No. JM 10106C).

Appendix to Part I

The writer was able to read Cox's papers (1942, 1944), after Part I (NAKAZAWA, 1952) had been printed. COX restudied the species of *Pseudolimea* in detail, and stated (1944, P. 75) ".....the presence of these teeth, far from being a character of generic importance, may not even be a specific character. The Jurassic species which have been referred to *Limea* and the 'duplicata Limas' appear to form a well-characterized group which I now suggest should be united in a single genus for which Arkell's name *Pseudolimea* may be adopted"; he

considered that the teeth of the genus resembling those of Tertiary *Limea* was independent genetically, and separated *Pseudolimea* from *Lima* as a distinct genus. *Lima naumanni* KOBAYASHI and ICHIKAWA placed in the subgenus *Pseudolimea* with some doubt in Part 1 (Ibid., p. 102, Pl. IX, Figs. 7, 8, Pl. X, Figs. 3) is considered a Triassic *Pseudolimea* in ornamentation and shell-margins which are supposed to be not gaping, though the area is lacking in teeth.

According to COX (1942), the right valve of *Velata* in England including *V. abjecta* (PHILLIPS), the type species of the genus, has an obtuse triangular cardinal area above the hinge-margin, provided with a deep acute triangular resilifer pit, and has an internal ridge running postero-ventrally from just below the resilifer, which is, however, absent in *V. aubryi* (DOUVILLE) of Kachh in India. He suggested a close relation between *Velata* and *Pseudomonotis*, and moreover considered that for a group of Triassic species referred to *Velata* [*Velopecten*] by some authorities, the name *Leptochondria* BITTNER (1901) was available. *Velata maizurensis* NAKAZAWA in Part I (Ibid., pp. 97-98, Pl. VII, Figs. 3-6) is, perhaps, lacking in the internal ridge, but has the hinge-area of *Aviculopecten*-type like those of Jurassic *Velata* and Triassic *Leptochondria* (Pl. V, Fig. 9). This species has a more resemblance to *Velata* than to *Leptochondria*.

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Plate III

Explanation of Plate III.

- Bakevellia matsushitai* sp. nov. p. 214
- Fig. 1. Internal mould of an immature right valve (Reg. No. JM 10065) x 1, Loc. Miuchi, Oyogi, Ayabe City (Loc. No. N-402), Hor. Middle part of N₂ beds.
- Fig. 2. Internal mould of an immature right valve (Reg. No. JM 10064A) x 1, Loc. Kongoin, Kawara, Maizuru City (Loc. No. N-102), Hor. Middle part of N₂ beds.
- Fig. 3. Schematic sketch founded on the preceding, showing the hinge, x 1.5.
- Fig. 4a. Internal mould of a right valve, holotype (Reg. No. JM 10060), x 1, Loc. and Hor. ditto.
- Fig. 4b. Schematic sketch mainly founded on the preceding.
- Fig. 5. Gypsum cast of a left valve and a ligament-area of a right, their anterior margins being destructed, paratype (Reg. No. JM 10061) x 1, Loc. and Hor. ditto.
- Fig. 8. Internal mould of bivlaved valves, paratype (Reg. No. JM 10062A), x 1, Loc. and Hor. ditto. L: left valve, R: right valve.
- Bakevellia* cf. *matsushitai* p. 215
- Fig. 6. Internal mould of the hinge-area of a right valve (Reg. No. JM 10068), Loc. and Hor. ditto, showing traces of cardinal sockets (s'_1 , s'_2) on the ligament-area and pit.
- Fig. 7. Internal mould of a right valve (Reg. No. JM 10069), showing an edentulous cardinal hinge, Loc. and Hor. ditto.
- Bakevellia oyogiensis* sp. nov. p. 216
- Fig. 9. Internal mould of a right valve, paratype (Reg. No. JM 10082) x 2, Shinmichi, Ayabe City (Loc. No. N-404).
- Notations:—t: cardinal tooth, at: anterior cardinal tooth, pt: posterior cardinal tooth, l: lateral tooth, l₁: first lateral tooth, l₂: second lateral tooth, as: anterior cardinal socket, ps: posterior cardinal socket, s: lateral socket, s₁: first lateral socket, s₂: second lateral socket. Arrows showing appparent direction of elongation or compression by secondary deformation.
(All specimens here illustrated are kept in the Geological and Mineralogical Institute of Kyoto University.)

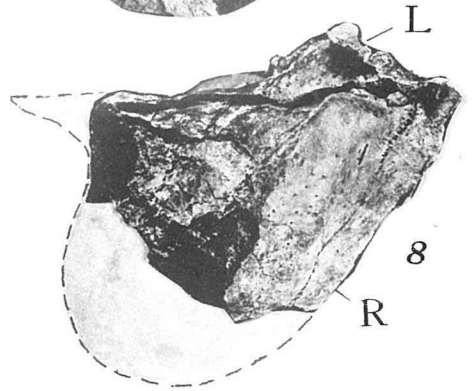
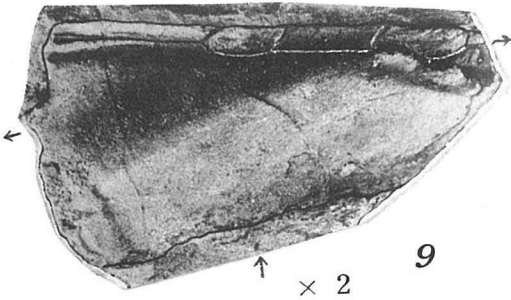
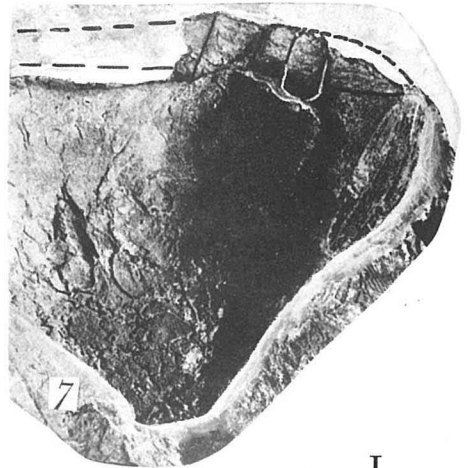
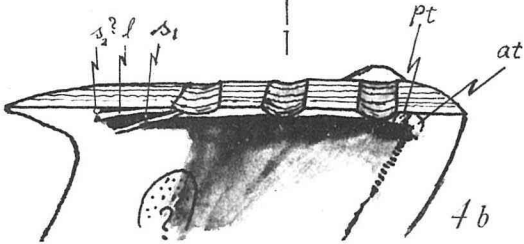
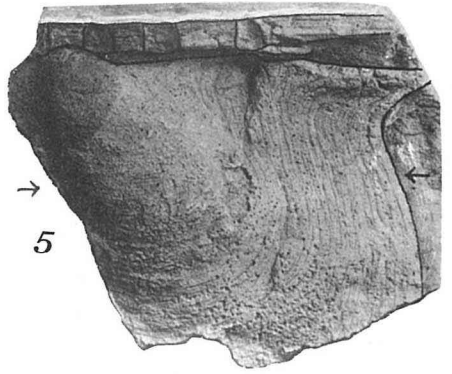
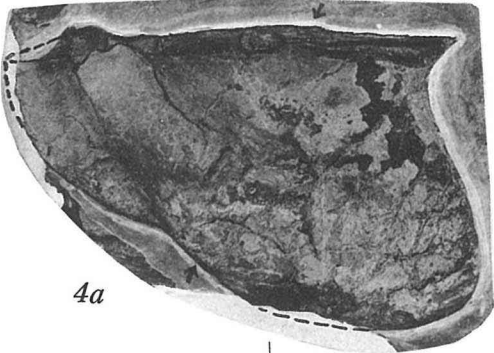
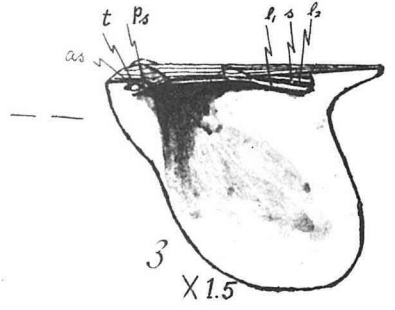
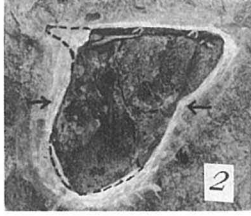
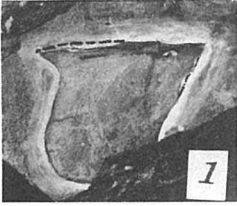


Plate IV

Explanation of Plate IV.

Bakevellia oyogiensis sp. nov. p. 216

Fig. 1. Gypsum cast of the external mould of a right valve, paratype (Reg. No. JM 10080) x 1, Loc. Terada, Maizuru City (Loc. No. N-304), Hor. Lower Part of N₃ beds.

Fig. 2. Gypsum cast of the external mould of a left valve, paratype (Reg. No. JM 10078) x 1, Loc. and Hor. ditto.

Fig. 3a. Internal mould of a right valve with attached left valve, holotype (Reg. No. JM 10067) x 2, Loc. Miuchi, Ayabe City (Loc. No. N-414).

Fig. 3b. Schematic sketch mainly founded on the same specimen, x 1.

Fig. 4. Schematic sketch of the internal mould of a right valve, showing musculature, x 1.

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Fig. 5. Internal mould of a right valve, paratype (Reg. No. JM 10090) x 1, Loc. Monobe (Loc. No. N-601), Hor. Lowest part of N₃ beds.

Fig. 6. Gypsum cast of the internal mould of a left valve, paratype (Reg. No. JM 10093), Loc. and Hor. ditto, x 1.

Fig. 7. Gypsum cast of the internal mould of left valves, paratype (Reg. No. JM 10091. B), showing a reverse deformation compared with the preceding, x 1, Loc. and Hor. ditto.

Fig. 8. Internal mould of the cardinal area of two left valves (a, b.), showing hinge structure (Reg. No. JM 10089b, c) x 4, Loc. and Hor. ditto.

Fig. 9a. Internal mould of a left valve, holotype (Reg. No. JM 10089a) x 1, Loc. and Hor. ditto.

Fig. 9b. Schematic sketch restored from the same, x 3.

Notations:—st: striation, a: anterior adductor scar, b: posterior adductor scar, c: pedal retractor scar, d: pallial line, dashed line: inferred outline. Other notations are the same in Pl. III. (All specimens here illustrated are kept in the Geological and Mineralogical Institute of Kyoto University.)

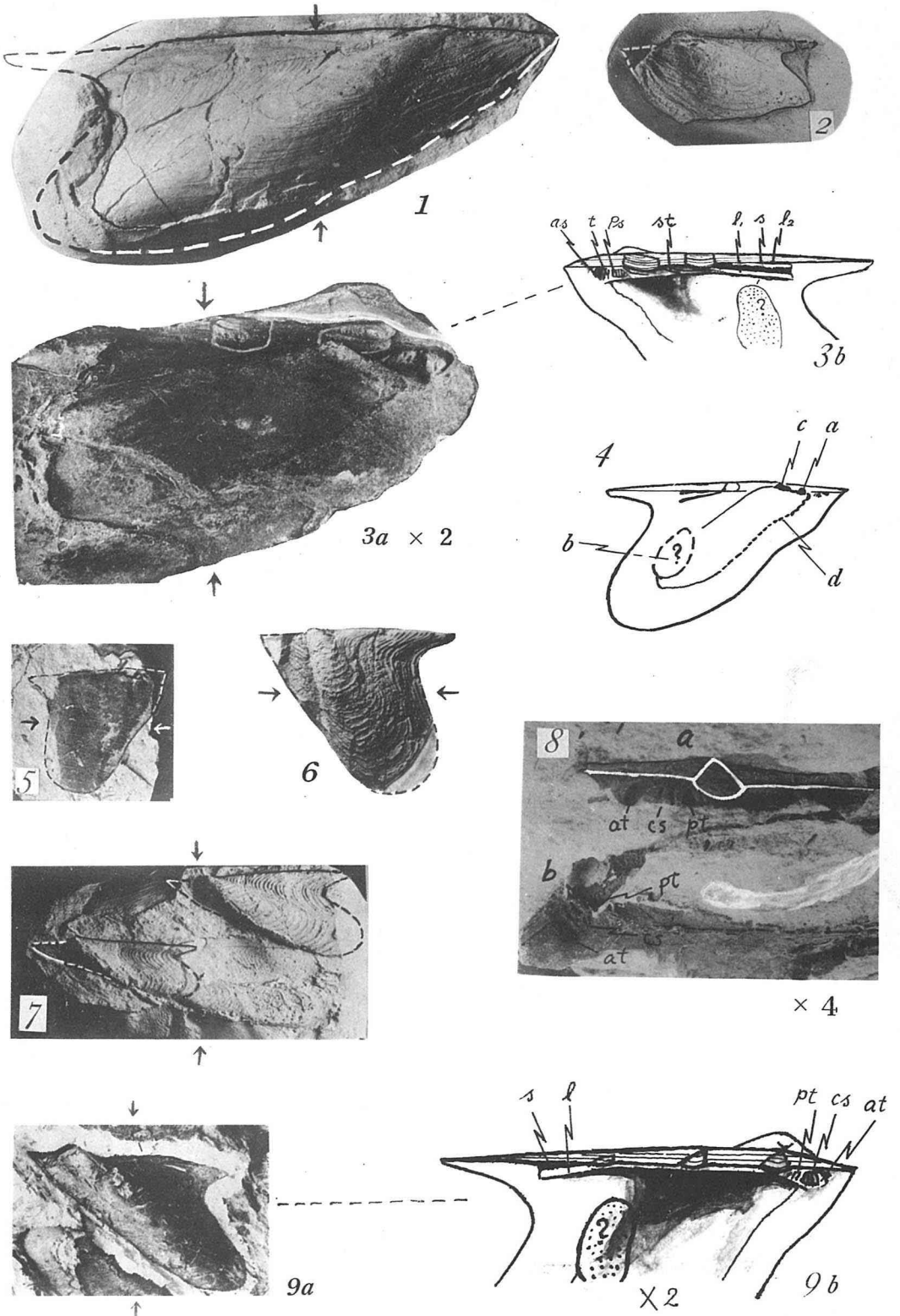


Plate V

Explanation of Plate V.

Bakevellia monobensis sp. nov. p. 217

Figs. 1a-d. Sketches of the internal moulds of hinge-area, showing various dentitions; 1a-c, left valves, x 3, 1d, right valve, x 2.5.

Fig. 2. Schematic sketch of the internal mould of a left valve, showing musculature x 1.

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Fig. 3a. Gypsum cast of the internal mould of a right valve (Reg. No. JM 10094A) x 1, Loc. Shinmichi (Loc. No. N-406), Hor. Lower part of N₃ beds.

Fig. 3b. Schematic sketch restored from the same specimen.

Fig. 4a. Internal mould of a right valve (Reg. No. JM 10096) x 1, Loc. and Hor. ditto.

Fig. 4b. Schematic sketch restored from the same specimen.

Fig. 5. Schematic sketch from the internal mould of a small right valve (Reg. No. JM 10097), showing primitive dentition, x 2.

Fig. 6a, b. Section of bivalved specimen along umbonal slope (A-B line in Fig. 6b), showing slightly inequivalved shells, and deep, slender incisions of the anterior adductors, x 1, l: left valve, r: right, m: adductor scar.

Fig. 7. Gypsum cast of the external mould of a left valve (Reg. No. JM 10098) x 1, Loc. and Hor. ditto.

Fig. 8. Gypsum cast of the external mould of the same specimen illustrated in Fig. 3 (Reg. No. JM 10094B) x 1, Loc. and Hor. ditto.

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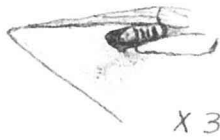
Fig. 9. Sketch of the internal mould of a left valve (Reg. No. JM. 10026), showing a hinge-area, x 1.5.

Notations:—ad: anterior denticles, pd: posterior denticles. Other notations are the same in Pl. III, and IV.

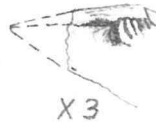
(All specimens here illustrated are kept in the Geological and Mineralogical Institute of Kyoto University.)



1a



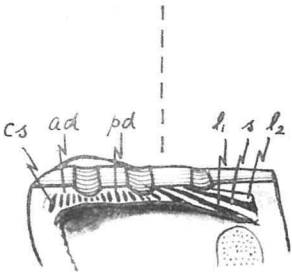
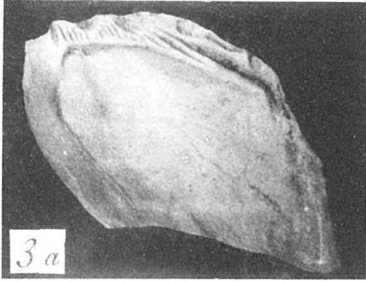
1b



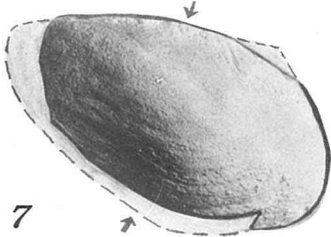
1c



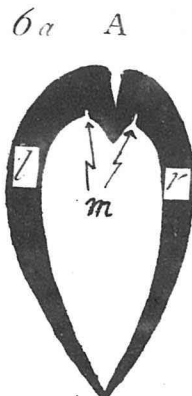
1d



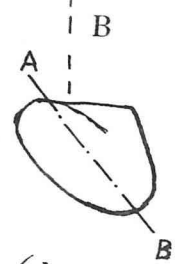
3b



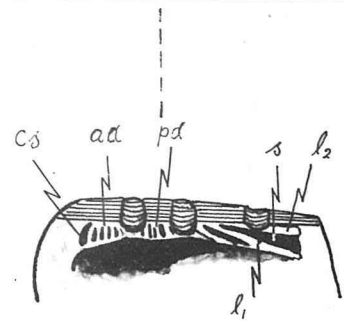
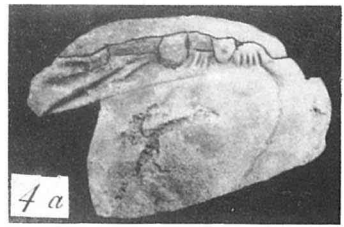
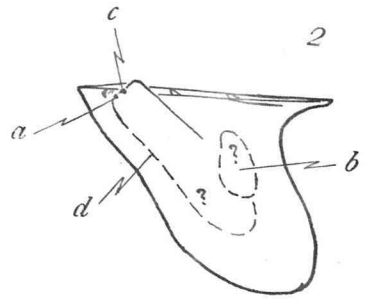
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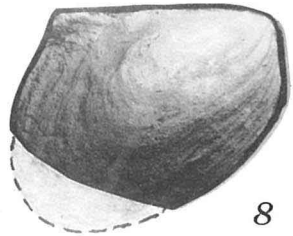
6a A



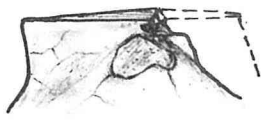
6b



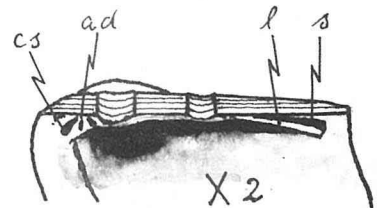
4b



8



9 x 1.5



5

Plate VI

Explanation of Plate VI.

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Fig. 1. Schematic sketch of the internal mould of a right valve, showing musculature, x 1.

Fig. 2. Internal mould of a right valve (Reg. No. JM 10099) x 2, Loc. Shinmichi (Loc. No. N-405), Hor. Highest part of *B. hekiensis* bed.

Fig. 3a. Internal mould of a left valve (Reg. No. JM 10100B) x 1, Loc. Miuchi (Loc. No. N-414), Hor. Lower part of N₃ beds.

Fig. 3b. Clay-cast of the external mould of the same specimen (Reg. No. JM 10100A), x 1.

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Fig. 4a. Internal mould of a right valve, broken off the ventral portion, holotype (Reg. No. JM 10107) x 1, Loc. Nabae (Loc. No. N-220), Hor. Uppermost part of N₁ beds.

Fig. 4b. Schematic sketch restored from the same; x 2.

Fig. 5a. Internal mould of a left valve, paratype (Reg. No. JM 10106) x 2, Loc. and Hor. ditto.

Fig. 5b. Restored sketch from the same, x 2.

Fig. 6a. Internal mould of a left valve, holotype (Reg. No. JM 10108) x 1, Loc. and Hor. ditto.

Fig. 6b. Schematic sketch from the same, x 2.5.

Fig. 7. Sketch of the primitive hinge of a small, immature specimen (Reg. No. JM 10109a), Loc. and Hor. ditto, x 3.

All notations are the same in Pl. III, IV and V.

(All specimens here illustrated are kept in the Geological and Mineralogical Institute of Kyoto University.)

