STUDIES ON FOSSIL DEER OF THE DOI COLLECTION FROM THE SEA BOTTOM OFF TOMOGASHIMA ISLANDS IN THE OSAKA BAY (PLEISTOCENE DEER FAUNA IN SETO INLAND SEA, WEST JAPAN-PART II)

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STUDIES ON FOSSIL DEER OF THE DOI COLLECTION FROM THE SEA BOTTOM OFF TOMOGASHIMA ISLANDS IN THE OSAKA BAY (PLEISTOCENE DEER FAUNA IN SETO INLAND SEA, WEST JAPAN–PART II)

By

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Introduction

The present paper deals with the result of paleontological study on the late Pleistocene fossil deer fauna which has been collected from the sea bottom deeper than 60 meters in depth, 3 km north of Tomogashima Island, located at the mouth of Osaka Bay. It is associated with abundant specimens of NAUMANN's elephant (*Paleoloxodon naumanni*) and few fossil cetacea. These are now stored in the specimen room of the Hojuji temple of the Fuké town, Sennan-gun, Osaka Prefecture. I named these specimens the DOI Collection after Mr. Kansho DOI, the chief priest of the Hojuji temple, who made efforts to collect these specimens dredged by fishermen in the Fuké town.

Deer fossils in the DOI Collection are represented by the antler specimens although most of them are much broken. As the result of study, five species of the fossil deer belonging to the genus *Cervus* were descriminated. One of them is judged to be a tropical deer from the resemblance to the Swamp Deer (*Cervus* (*Rucervus*) *duvaceli* G. CUVIER) now living in Peninsula India. The discovery of a tropical deer seems to be very important for the consideration of the Late Pleistocene climate and of the migration route of the deer fauna and the NAUMANN's elephant in the Japanese Islands at that time.

Before going further, I wish to express my deep gratitude to Professor Shozo HAYASAKA of the Kagoshima University for his continuous encouragements and careful reading the manuscript and to Professor Tadao KAMEI of the Kyoto University who gave me valuable information about the deer fossils of the DOI Collection. I am also greatly indebted to Mr. Kansho DOI of Fuké Town of Sennan-gun, Osaka Prefecture, for his kind donation of the important specimens in his collection.

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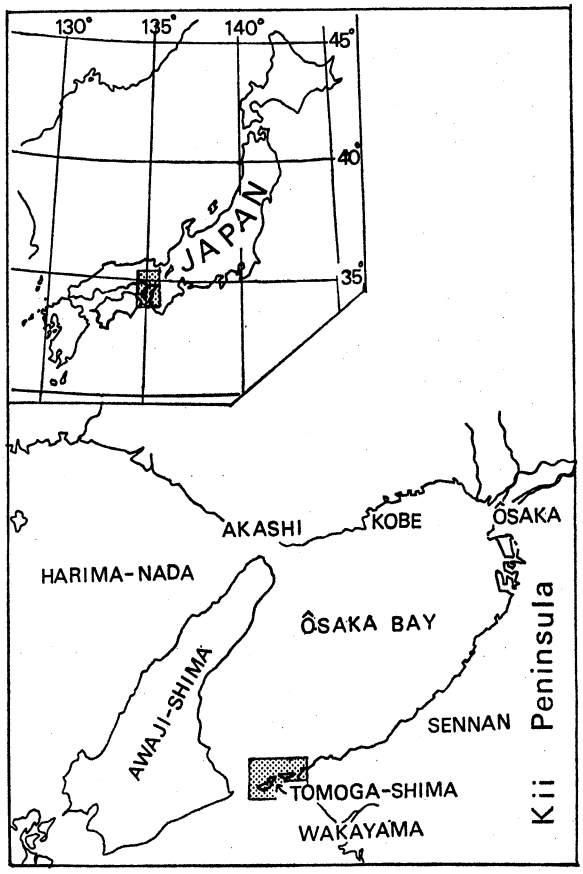
Deer Assemblage from off Tomogashima Island

As the result of study on deer assemblage found from off Tomogashima Islands, 4 species of the fossil deer referable to the family Cervidae were discriminated, namely *Cervus* (*Sika*) cf. *greyi* (ZDANSKY), *C.* (*S.*) *paleoezoensis* OTSUKA & SHIKAMA, *C.* (*Nipponicervus* ?) *takaoi* OTSUKA & SHIKAMA and *C.* (*Rucervus*) *katokiyomasai* SHIKAMA & HASEGAWA. Among them, the former three species are commonly known in the Late Pleistocene deer assemblage in the TAKAO Collection (OTSUKA and SHIKAMA, 1976) obtained from the sea bottom off the Shodoshima Island. The TAKAO Collection represents so-called the *Sika-Nipponicervus* assemblage which comprises a complex consisting of such older elements of Early- to Middle Pleistocene faunae as *C.* (*N.*) *praenipponicus*, *C.* (*N.*) *kazusensis*, *C.* (*S.*) cf. *greyi*, *C.* (*S.*) *natsumei*, *C.* (*N.* ?) *takaoi* and of such younger one of the Late Pleistocene as *C.* (*S.*) *paleoezoensis*, *Elaphurus menziesianus* and *Sinomegaceros yabei*. Among them, younger elements of the subgenus *Sika* exceed older ones of *Nipponicervus* in individual number. This assemblage resembles those of the Late Pleistocene Isa or Upper Kuzuü faunae in the predominance of *Cervus* (*Nipponicervus*) *praenipponicus*, *C.* (*N.*) *kazusensis* and the occurrence of *Sinomegaceros* (*Sinomegaceroides*) *yabei*, but can be distinguished from the latter two faunae by the occurrence of *E. menziesianus* and the frequent occurrence of species of the subgenus *Sika*. Therefore, I and SHIKAMA (1976) concluded that the Shodoshima deer assemblage is very important as the representative one inhabiting the lowland area of Japan in the late Pleistocene age.

Although the specimens treated are rather few in number of species, the faunal characters of the deer assembalge known from off Tomogashima Islands fall within the category of *Sika-Nipponicervus* assemblage from off Shodoshima Island. Strictly speaking, however, the former seems to be somewhat different from the latter in the absence of *Sinomegaceros* (*Sinomegaceroides*) *yabei*, *C.* (*S.*) *natsumei* MATSUMOTO, *Elaphurus menziesianus* (SOWERBY) and *C.* (*Nipponicervus*) *kazusensis* MATSUMOTO. The occurrence of *C.* (*Rucervus*) *katokiyomasai* SHIKAMA & HASEGAWA is noticeable. It closely resembles the tropical deer called the Swamp Deer (*C.* (*Rucervus*) *duvaceli*) living in rather limited area of the upper Narbada Valleys in India. Nowadays many mammalian fossils with the NAUMANN's elephant were recorded from the Japanese Islands, however, no tropical elements have been known untill now. Therefore, the discovery of *Cervus* (*Rucervus*) in the deer assemblage off Tomogashima Islands seems to very important not only for the consideration of the migration of the Late Pleistocene deer fauna and the NAUMANN's elephant in Seto Inland Sea but also climatic conditions at that time. The final conclusion about this problem shall be given at the final step of this serial study.

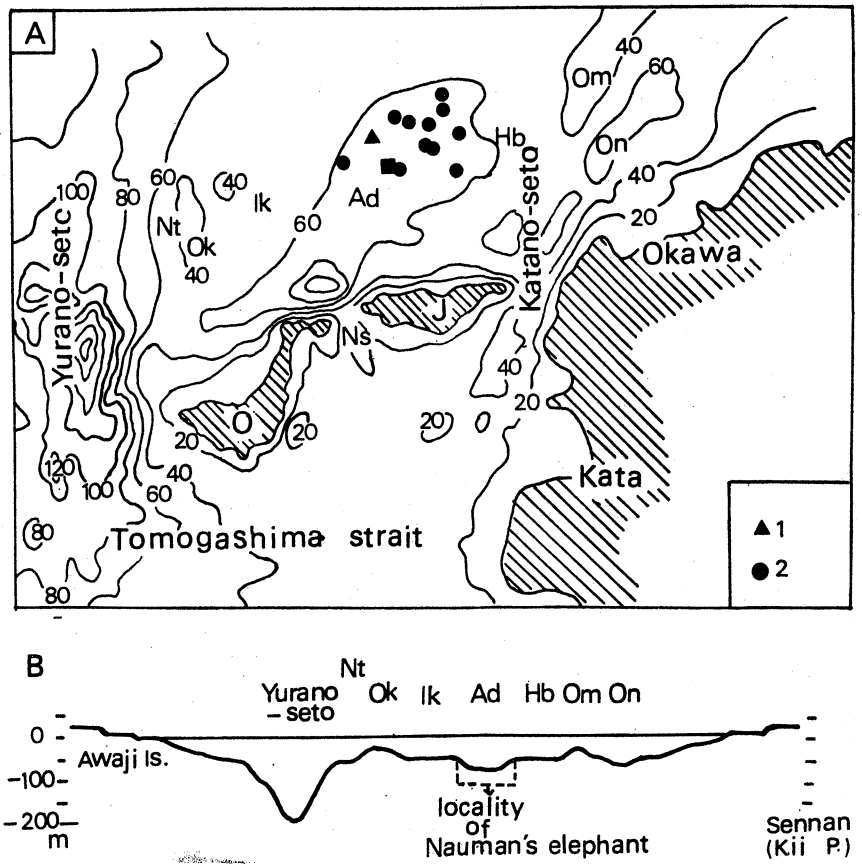
Submarine Topography and Geological Setting of the Fossiliferous Site off the Tomogashima Islands

The Tomogashima Islands consisting of two small islands named the Okinoshima



Text-fig. 1. Map showing the position of the fossil site off the Tomogashima Island, near Osaka Bay.

Text-fig. 2. Map showing the submarine topography (A) and its profiles (B) of the area north of the Tomogashima Island. 1: locality of the NAUMANN's elephant; 2: stations where the Pleistocene marine clay specimens were dredged Ok: Okinoshima; J: Jinoshima; Nt: Nishitowasuji; Ok: Okozenose; Ik: Ikaba; Ad: Ainodei; Hb: Hazeba Om: Ôkawamae; On: Ôkawanomae; Ns: Nakanoseto [after ITIHARA (1961)].



in the west and the Jinoshima in the east are situated in the bay-mouth of Osaka Bay between the Awajishima and the western extremity of the Kii Peninsula. The Okinoshima is separated from the Awaji-shima by a deep channel called the Tomogashima channel having a depth of 180 m in maximum, while the Jinoshima is separated from Kii Peninsula by a narrow channel called the Katano-seto. In the area northwest of the Okinoshima, the Tomogashima channel is called locally the Yurano-seto.

The sea bottom immediately north of the Tomogashima islands is shallower than 60 m in depth and characterized by the development of reliefs comprising Nishitowa-suji, Okinose, Okawa-mae and Okawano-mae from west to east, which are local names given by fishermen for convinience.

According to ITIHARA (1961), the submarine topography and geology of the area north of Tomogashima Islands are given as follows: the bottom sediments in this area are represented by sand and gravel or sandy mud at Okozeno-se and Okawamae both shallower than 40 m and in the area between Tanagawa and Myojin-zaki; sand and gravel at Nishitowa-suji, Ikaba and Hazeba ranging in depth from 40 to 60 m; sand and gravel and mud as the Recent sediments, Pleistocene marine clays and the probable pre-Pleistocene bed rocks in the area deeper than 60 m such as Aino-dei and Okawamae. Submarine topography, distribution of the bottom sediments and exposure of bed rocks seem to be controlled by the tidal currents passing through the narrow straight between the islands may contribute to form a marine troughs locally called Yurano-seto, Katanoseto, Aino-dei and Okawa-mae and also to cover the bed rocks with post-Pleistocene marine sediments in the area between these troughs. Therefore, around the Tomogashima Islands, we can recognize three areas characterized by the following major features; 1) the area of erosion (deeper than 60 m), 2) the area of sedimentation (shallower than 40 m) and 3) the transitional area from erosion to sedimentation (depth from 60 m to 40 m).

The specimens of the NAUMANN's elpehant and other fossil vertebrates including deer fossils were dredged mostly from the northern part of Aino-dei. Some blocks of the Pleistocene marine clays bearing fossil molluscs and foraminifers were also dredged from this area. Furthermore, fossil tusks of elephant and limonitized sand-pipes were also obtained from the sea bottom of the northwestern margin of Aino-dei (ITIHARA, 1961). Judging from these evidences, ITIHARA (1961) had an opinion that the mammalian fossils must be derived from the Pleistocene marine clay bed.

To clarify the stratigraphic position of mammal-bearing bed exposed on the sea floor north of the Tomogashima Islands, it is necessory to examine the record on the mode of occurrence of fossil mammals in the neighbouring land area.

The southeastern coastal area of the Osaka Bay, which extends from Sakai City to Misaki town, is called the Sennan-Senpoku area. The geology of this area, which was recently summerized by ITIHARA *et al.* (1975), is represented by the Plio-Pleistocene Osaka Group and the middle to late Pleistocene terrace deposits. The Osaka Group gently dipping northward or northwestward unconformably overlies the

pre-Tertiary basement rocks and forms a vast hilly land. The terrace deposits are widely distributed along the lower- to middle reaches of each river flowing into Osaka Bay.

The Osaka Group, one of the standard Plio-Pleistocene successions in Japan, is composed of gravel, sand, silt and thier alternation with well-traceable thin layers of tuff in various horizons. This group has been divided into two parts, the lower and the upper. In the lower part, the lowermost part is characterized and discriminated by the beginning of the so-called "*Metasequoia* flora" extinction (Itihara, 1960, 1961). In general, the upper part consists of the deposits of cyclic sedimentation showing the lacustrine or embayment environments, while the lower part is regarded to be the lacustrine sediment throughout. The cyclic sedimentation of the upper part has been considered to be resulted from transgression and regression corresponding to the climatic and eustatic changes. Eight thin layers of marine clay have been recognized to occur in the Osaka Group and are named Ma0, Ma1, Ma2 .... and Ma10 in ascending order.

For the frequent occurrence of mammalian fossils especially of Proboscidea, the Osaka Group has another importance. The biostratigraphic studies in regarded to the proboscidean fossils of this group have been made by Ikebe *et al.* (1966) and Kamei and Setoguchi (1970). In the Osaka Group and its correlatives, Kamei and Setoguchi (1970) recognized the following five zones of mammalian fossils in ascending order: 1. *Stegodon* cf. *elephantoides* Zone (3.4 m. y. B.P., Late Pliocene), 2. *Stegodon insignis sugiyamai* Zone (about 2.5 m.y. B.P., post Villafranchian), 3. *Stegodon shodoensis akashiensis* Zone (about 2.0–1.5 m.y. B.P., Upper Villafranchian), 4. *Elephas shigensis* Zone (about 1.5–0.6 m.y. B.P., Upper Villafranchian) and 5. *Stegodon orientalia* Zone (about 0.6–0.3 m.y. B.P., post Villafranchian). They regarded the each zones as: Zone 1 – the temperate forest elements of the Indo-Malayan faunal complex widely distributed in Southeast Asia and its environs in late Pliocene; Zone 2 and 3 – the reminants on the Indo-Malayan faunal complex and the temperate-forest to grassland elements of the Nohowan fauna of the earliest Pleistocene in North China; Zone 4 – the elements of Nihowan fauna and or the temperate-forest to grassland elements of the early Pleistocene Choukoutien fauna and Zone 5 — the temperate elements of the middle Pleistocene Wanhsien fauna vigorously developed in South China. Beside the proboscidean fossils, deer fossils such as *Elaphurus shikamai* Otsuka, *Cervus* (*Nipponicervus*) *kazusensis* and *Cervus* sp. have been recorded from the mammalian zones 2 and 3. Among them, *Elaphurus shikamai* indicates a close relationship of the present fauna with the Early Pleistocene Nihowan Vertebrate fauna in North China (Otsuka, 1972).

The terrace deposits developed in the Sennan-Senpoku area have been divided into the High, the Middle and the Lower ones based on the altitude of depositional surface (Itihara *et al.*, 1975). A fragmental molar of *Palaeoloxodon naumanni* Makiyama and found from the Middle Terrace deposits in Kishiwada City correlative to the Uemachi Formation in the type area (Ikebe *et al.*, 1966).

As to the mammal-bearing formation at the sea bottom off the Tomogashima

Islands, ITIHARA (1961) has presumed that the Pleistocene formation containing the NAUMANN's elephant must be a part of the Uemachi Formation considering the geologic structure of the Pleistocene deposits in the surrounding land area.

The mammalian assemblage known from off the Tomogashima comprises abundant specimens of NAUMANN's elephant and deer of the so-called younger elements mentioned above and lacks in other kind of elephant and archetypal cervids such as *Stegodon*, *Elephas* and *Elaphurus* characterizing the Early Pleistocene Osaka Group. Consequently, I attained to the conclusion that the Pleistocene deposits at the bottom off the Tomogashima Islands can be correlated to the Middle Terrace deposits (the Uemachi Formation) in the Sennan-Senpoku area, south of Osaka.

Description

Order Artiodactyla
Family Cervidae GRAY, 1821
Genus *Cervus* LINNAEUS, 1785
Subgenus *Sika* SCLATER, 1870

Type-species. – *Cervus nippon* TEMMINCK, 1873

Cervus (*Sika*) *paleoezoensis* OTSUKA and SHIKAMA
Plate 1, Figs. 1a-1b.

Compare with:-

Cervus (*Sika*) *paleoezoensis* OTSUKA and SHIKAMA, 1976, *Bull. Natn. Sci. Mus.*, ser. C, Geol. & Paleo., vol. 2, no. 3, p. 1–40.

Specific diagnosis. – See OTSUKA and SHIKAMA, 1976.

Referred specimen. – HM* Reg. No. 176, a right shed antler.

Description of the specimen. – A stout and rather thick right shed antler (HM Reg. No. 176; Pl. 2, fig. 1a and 1b) about 300 mm in preserved length from the burr to the broken end of the beam is in the collection. Burr is thin and circular in outline. The first tine about 70 mm in preserved length is forked at relatively low position above the burr (about 40 mm), making an angle of about 88 degrees with beam. It is strongly depressed laterally and shows suboval outline near the base. Beam above the first fork streches postero-upwardly from the beam above the burr with a gentle curvature. The middle portion of the beam is nearly circular in section but the inner-antero corner of it is somewhat squared. Beam below the first fork is very stout and less constricted and its outer surface is very concave. Surface of the antler covered with longitudinal furrows, being rather deep on the posterior surface and somewhat shallow on the anterior surface.

Measurements are as follows:-

Thickness of burr 7 mm (in maximum); Diameter of beam below first fork 48.5 mm × 34.7 mm; Height of first fork 40 mm; Angle of first fork 88; Length of first tine +77 mm; Length of beam above first fork +260 mm; Diameter of beam at middle portion

* Abbreviation for the specimen room of the Hôjuji at Misaki town, Osaka Prefecture.

above the first fork 30.6 mm×32.7 mm.

Comparisons. – From the size and the mode of forking of the antler, this specimen is referred to *Cervus* (*Sika*) *paleoezoensis* Otsuka and Shikama described from the sea bottom off Shakagahana of the Shodoshima Island (Otsuka and Shikama, 1976). Among the specimens of this species from off the Shodoshima Islands, two types were recognized, namely, A and B. The antler specimens referable to Type A show a wide range of variation. For instance, the height of the first fork ranges from 15 mm to 45 mm, suggesting the different growth stages. Type B differs from Type A by shorter and less lyrated beam, somewhat narrower angle of the first fork, and weakly constricted beam below the first fork. These spedimens were discriminated from the living Japanese deer (*Cervus nippon*) in having wide angle of the first forking and from *C.* (*S.*) cf. *greyi* (Zdansky) by its narrower angle of the first forking. The antler specimen at hand falls within the category of the Type A of *C.* (*S.*) *paleoezoensis*.

Cervus (*Sika*) cf. *greyi* (Zdansky)
Plate 2, Figs. 1a–1b, 2a–2b

Compare with. –

Pseudaxis greyi Zdansky, Zdansky, 1925, *Pal. Sinica*, ser. C, vol. 2, fasc. 3, p. 65–72, Taf. XIII, figs. 2–12.

Cervus (*Sika*) cf. *greyi* (Zdansky), Otsuka and Shikama, 1976, *Bull. Nat. Sci. Mus.*, ser. C, Geol. & Paleo., vol. 2, no. 3, p. 1–40.

Referred specimens. – Two shed antler specimens are in the collection. One of them (HM175) lacks the tine above the second fork and a tip portion of the first tine, while another (HM185) lacks the upper half above the middle portion of the beam between the first and the second forks.

Specific diagnosis. – See Otsuka andd Shikama, 1976.

Description of the specimens. – A left shed antler (HM Reg. No. 175; Pl. 2, Figs. 1a–1b) is about 244 mm in preserved length from the burr to the broken end of the beam. A distal portion of the beam and a tip of the first tine are broken off. Burr is rather thick, oval in outline and broad in fore-and-aft direction. The first tine long, oval in outline and directed antero-upward with a gentle curvature. It is forked at rather low position (about 32 mm) above the burr making an angle of 95 degrees with the beam. In lateral view, the beam is more lyrated backwards than in the case of the living Japanese deer, while in frontal view, it declines outwards. Surface of the beam appears moderately rugose due to shallow, rather wide furrows.

A left, shed antler (HM Reg. No. 185; Pl. 2, Figs. 2a-2b) is 280 mm in preserved length from the burr to the broken end above the second fork. Burr is about 8 mm and nearly oval in outline. Beam below the first fork is short and has nearly oval outline with somewhat concave outer surface. The first tine, about 95 mm in preserved length, is projected forward and somewhat upwards making an angle of about 100 degrees with the beam. It is much depressed laterally in the basal part. The distance between the first and the second forks is 247 mm along the outer border. The inner

surface of the beam is almost flat while the outer much distends outward. Front or outer tine of the second fork makes an angle of about 80 degrees with the hind (or inner) tine. Surface of the antler is provided with many shallow longitudinal furrows and moderately rugose in appearance.

Comparisons. – Many antler specimens of *Cervus* (*Sika*) cf. *greyi* (ZDANSKY) were recorded from the sea bottom off the Shodoshima Island (OTSUKA and SHIKAMA, 1976). This species was discriminated from *Cervus* (*Sika*) *nippon* TEMMINCK and *Cervus* (*Sika*) *paleoezoensis* OTSUKA and SHIKAMA by its large angle of the first fork and short beam. This species is divided into two types A and B based upon the difference in height and in angles of the first fork. Among them, the antler of the Type A shows low positions of the first fork ranging from 18 mm to 40 mm in height and angles of the first fork ranging from 80 to 90 degrees, while the Type B shows wider angles more than 90 degrees and moderate height of the first fork ranging from 25 mm to 35 mm.

Two left shed antlers at hand (HM175 and HM185) are safely referred to the Type B of *C.* (*S.*) cf. *greyi* (ZDANSKY) from off the Shodoshima Island. The present species is allied to, but differs from *C.* (*Rucervus*) *katokiyomasai* SHIKAMA and HASEGAWA by narrower angle of the first fork.

Cervus (*Rucervus*) *katokiyomasai* SHIKAMA and HASEGAWA
Plate 3, Figs. 1a-1b; Text-figs. 3 and 4.

Compare with.–

Cervus (? *Rucervus*) *katokiyomasai* SHIKAMA and HASEGAWA, SHIKAMA and HASEGAWA, 1965, *Sci. Rep. Yokohama Nat. Univ.*, ser. 2, no. 12, p. 45–47.

Referred sepecimen. – HM Reg. No. 220 (Pl. 3, figs. 1a–1b), a left antler with frontal bone attached.

Remarks. – *Cervus* (? *Rucervus*) *katokiyomasai* SHIKAMA and HASEGAWA (1965) was established based upon a right shed antler stored in the Department of Geology, Kumamoto University. At that time, they considered that a specimen might be derived from the sediments which is probably exposed on the sea bottom of Ariake Sea, North Kyushu. However, the succeeding inquires about correct locality made it clear that the type specimen of this species was obtained by the dredge from the Seto Inland Sea. I suppose that the formation from which the type antler specimen in question was derived may be of the same age as the NAUMANN's elephant-bearing bed or its correlative in the Seto Inland Sea.

The type antler specimen was precisely described by the original authors. It was difficult, however, to give the specific diagnosis based on the whole characters of the antler of this species because it is an incomplete, immature, shed antler. Fortunately, the specimen at hand is much better in preservation than the type specimen and seems to represent the antler of full-grown male safely referable to that of *Cervus* (*Rucervus*) *katokiyomasai* SHIKAMA and HASEGAWA.

Specific diagnosis. – The deer has medium to large size antler. The pedicle and

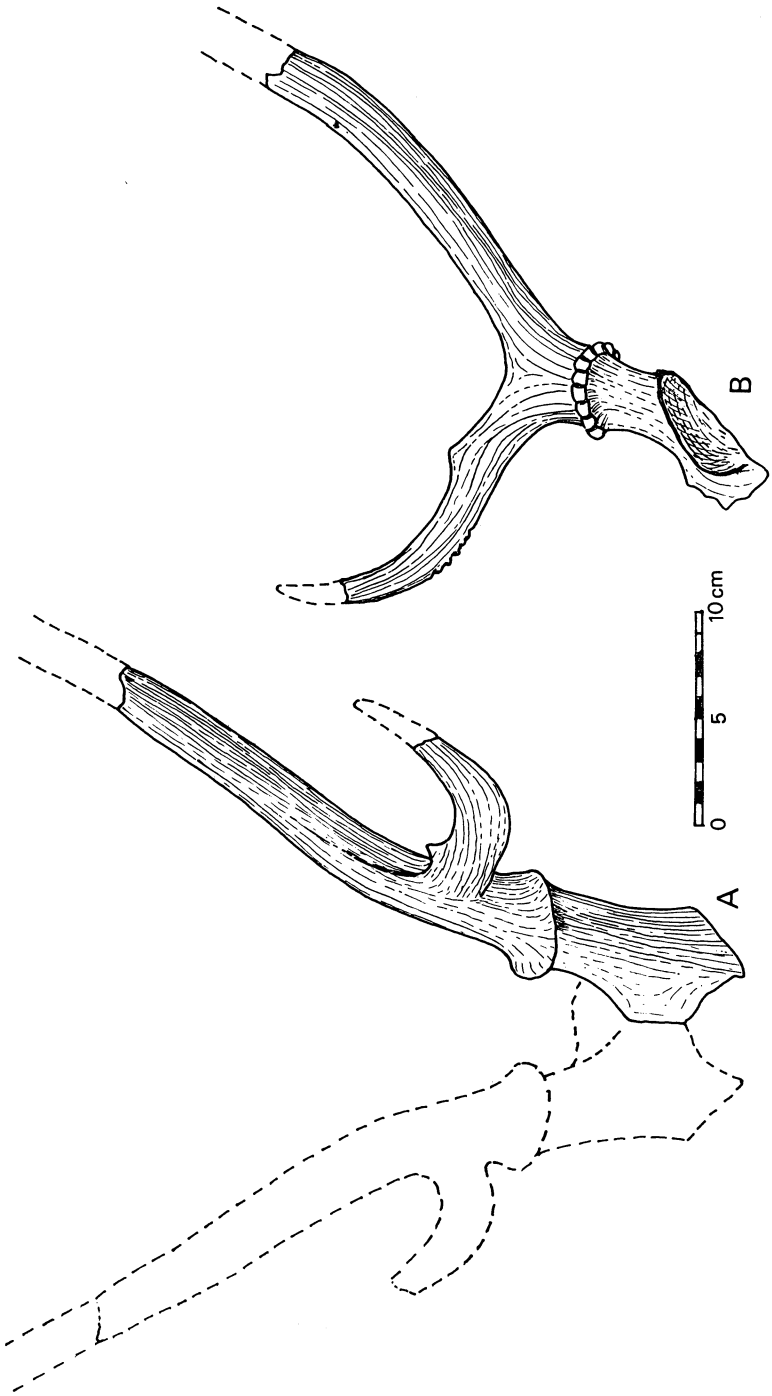
the antler extend outward making an angle of about 45 degrees with each other. The first tine forked at rather low position above the burr is long and projects forward making angles more than 100 degrees with the beam. A small obtuse snag is sometimes recognized on the upper surface of the first tine. The beam above the first fork is also long, circular in outline and much lyrated backward. The characters of the distal portion of the beam and the other osteological features are unknown.

Description of the specimen. – A left antler with a frontal bone (HM Reg. No. 220; Pl. 3, Figs. 1a, 1b) is about 351 mm in preserved length. The pedicle is nearly circular in section, measuring 30.8 mm long along the posterior border. The burr is thick and has almost oval outline. The beam below the first fork is short and weakly constricted. The first tine is long and gently curved measuring 161 mm in length. It is forked at a point 42 mm above the burr making an angle of 115 degrees with beam. A small snag is recognized on the upper surface of the first tine. The beam above the first fork has 214.8 mm in preserved length and much lyrated backwards, making a wide angles with the first tine. Measurements are as follows (in *mm* or *degrees*):-

Diameter of burr 52.5×46.7; Thickness of burr 8.6–9.2; Length of pedicle 30.8; Diameter of pedicle 34×36; Diameter of beam below first fork 43.0×31.7; Length of first tine +161; Height of first fork 41.5; Diameter of beam between first and second forks 27.0×25.6; Preserved length of antler +250; Angle of first fork 115.

Comparisons. – The present specimen is an antler of full-grown male of *Cervus* (*Rucervus*) *katokiyomasai* Shikama and Hasegawa showing the features much better

Text-fig. 3. A right shed antler of immature male (NSM6586) of *Cervus* (*Rucervus*) *katokiyomasai* Shikama and Hasegawa, Holotype [after Shikama and Hasegawa (1965)]. (×0.4).



Text-fig. 4. Antler of *Cervus katokiyomasai* SHIKAMA and HASEGAWA (Reg. No. HM220). Frontal (A) and lateral (B) views.

than the holotype. The mode of forking of the present species indicates the identity to the subgenus *Rucervus*, which is known to live in a large continental area of the southeastern Asia and in the island of Hainan. The subgenus *Rucervus* comprises three living species such as *C.* (*R.*) *duvauceli* CUVIER, *C.* (*R.*) *schomburgki* BLYTH and *C.* (*R.*) *eldi* M'CELLAND. According to LYDEKKER (1915), these species are characterized as follows:-

A. Brow-tine of antlers more or less differentiated from beam
   a. Beam of antlers undivided for a considerable distance above origin of brow-tine, which is not forked .....*C.* (*R.*) *duvauceli*
   b. Beam of antlers dividing a short distance above origin of brown-tine, which is frequently forked .....*C.* (*R.*) *schomburgki*

B. Brow-tine of antlers continuous with beam ..... *C.* (*R.*) *eldi*

The first tine (or brow-tine) of *C.* (*R.*) *katokiyomasai* is more or less differentiated from the beam and a small snag is developed on the upper surface of the first tine. Therefore, *C.* (*R.*) *katokiyomasai* is judged to be more closely resemble *C.* (*R.*) *duvauceli* than the other living species. But the former is discriminated from the latter in having more large angles and higher point of the first fork. The present species is also allied to but differs from the *C.* (*R.*) *eldi* by a brow-tine of the antlers differentiated from the beam.

Subgenus *Nipponicervus* Krezoi, 1941

Type-species. – *Cervus* (*Nipponicervus*) *praenipponicus* SHIKAMA, 1936.

Cervus (*Nipponicervus* ?) *takaoi* OTSUKA and SHIKAMA

Plate 1, Figs. 2a and 2b

Compare with. -

Cervus (*Nipponicervus* ?) *takaoi* OTSUKA and SHIKAMA, 1976, *Bull. Natn. Sci. Mus.*, vol. 2, no. 4, p. 33–36, pl. 6, figs. 1–9.

Rusa sp., NAORA, 1970, *Sci. Rep. Inst. Min. Ind. Fac. Sci. Eng. Waseda Univ.*, no. 26, p. 55–61, fig. 3.

Referred specimen. – HM Reg. No. 193, a left antler with a pedicle attached.

Specific diagnosis. – See OTSUKA and SHIKAMA, 1976.

Description of the specimen. – A fragment of a left antler with a pedicle attached (HM193; Pl. 1, fig. 2) is 486 mm in preserved length. The pedicle is rather short, measuring 30 mm long along the posterior border. Burr is thin and measuring 43 mm in maximum diameter. The antler is very slender and slightly lyrated backwards. The first tine, which is completely broken off from the base, is forked at rather low position (33.5 mm) above the burr. The beam is slender and 365 mm long as preserved along the outer border. Surface of the beam is rather rugose in appearance with many deep furrows and tubercles. A point of the second forking is not preserved although it is infered to be about 400 mm above the first fork. In anterior view, long antler declines outward making about 80 degrees with opposite antler, if restored.

Comparisons. – Although the present specimen is incomplete, it is referable to

Cervus (*Nipponicervus* ?) *takaoi* OTSUKA and SHIKAMA from off Shodoshima Island by long beam and short distance of the beam from the burr to the first forking point. However, present specimen somewhat differs from the holotype in having rugose surface.

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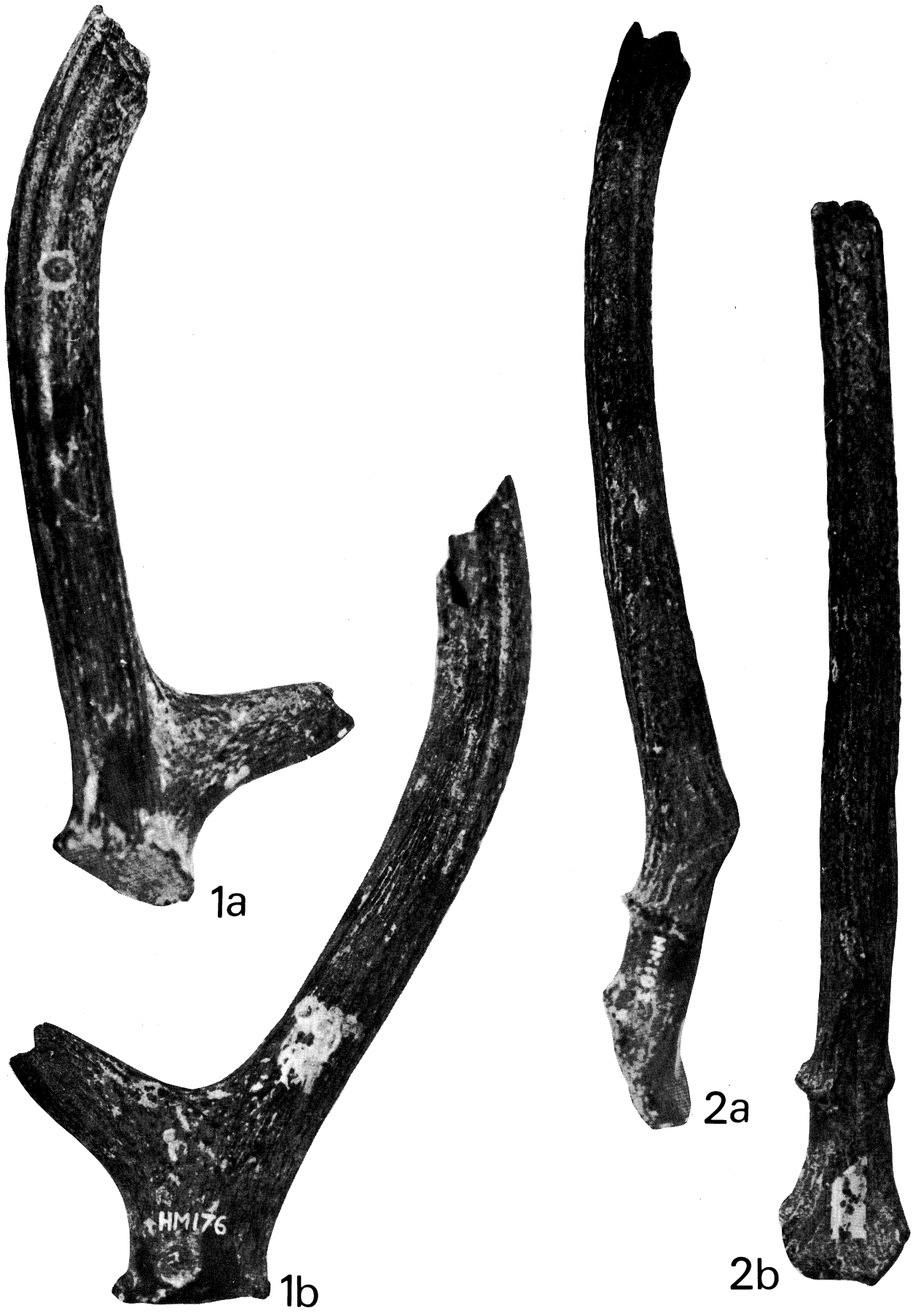
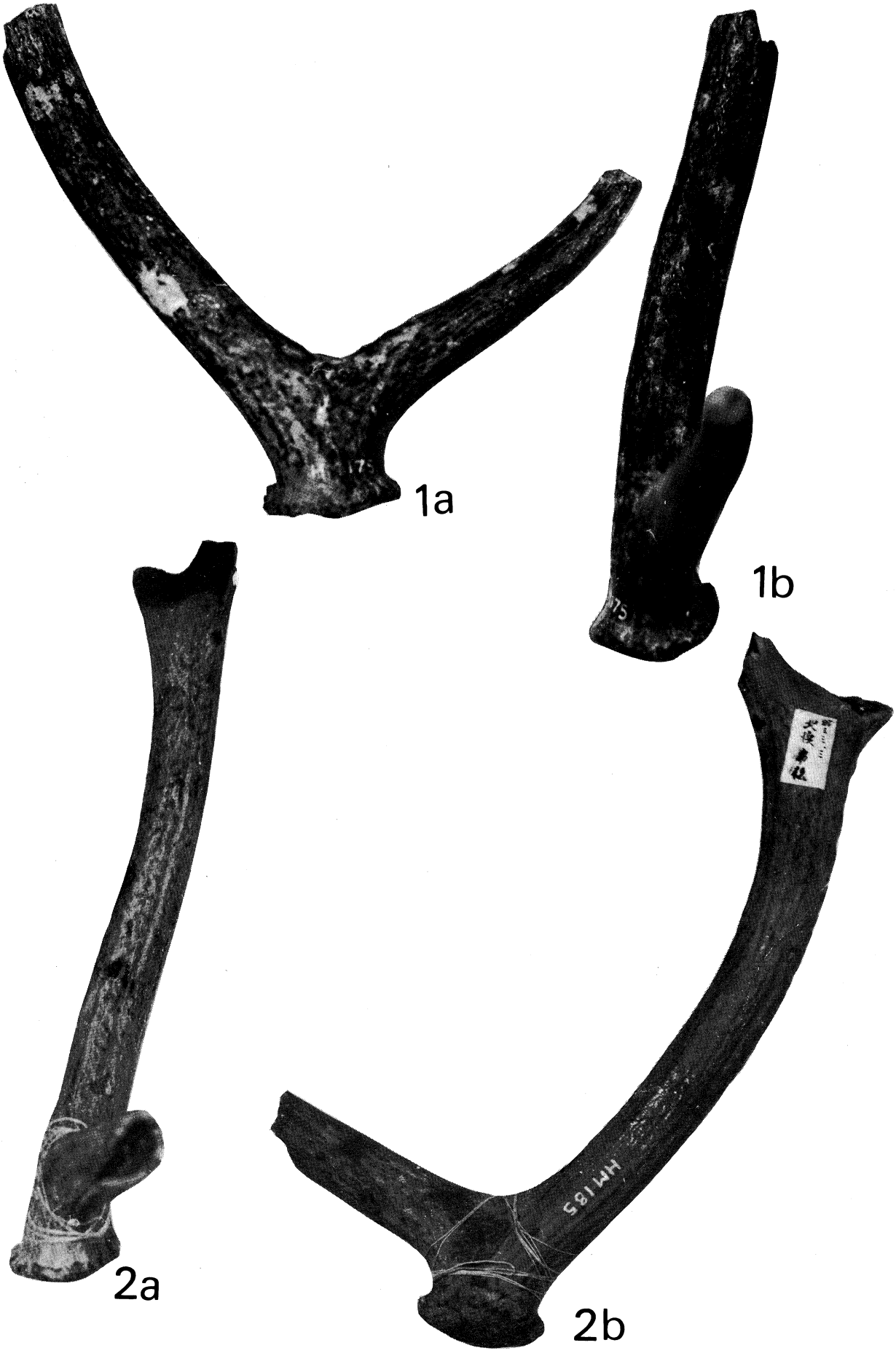
Explanation of Plate 1

Fig. 1. *Cervus* (*Sika*) *paleoezoensis* OTSUKA & SHIKAMA Page 46–47.
A right shed antler (HM176). Outer (a) and inner (b) views, × 0.45.

Fig. 2. *Cervus* (*Nipponicervus* ?) *takaoi* OTSUKA and SHIKAMA....Page 51–52.
A left antler with pedicle attached (HM193). Inner (a) and outer (b) views, ×0.35.


1a
HM176
1b
2a
2b


1a
1b
2a
2b
HM185

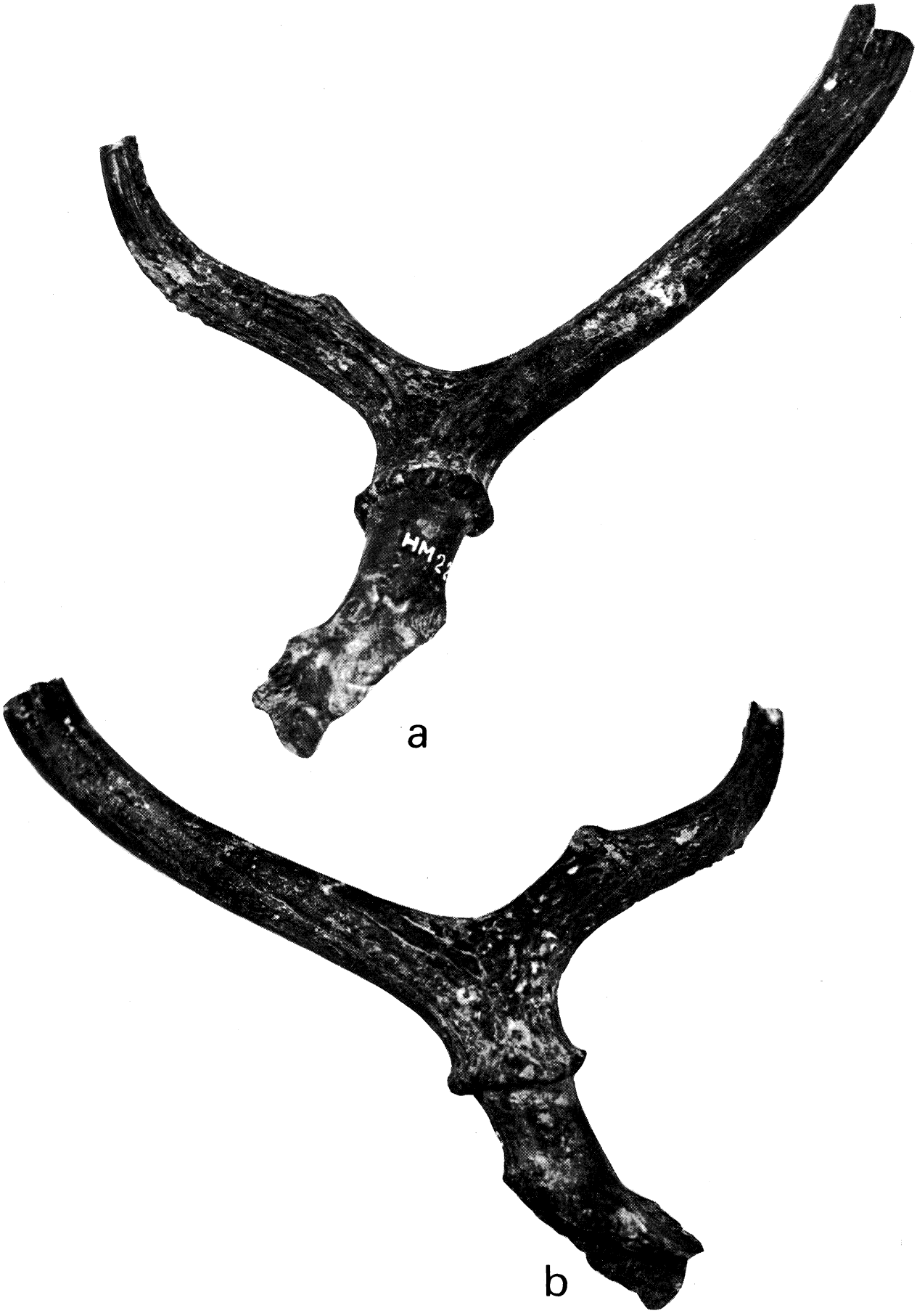
Explanation of Plate 2

Figs. 1-2. *Cervus* (*Sika*) cf. *greyi* (ZDANSKY) ....Page 47–48.

1. A left shed antler (HM175). Inner (a) and frontal (b) views, × 0.4.
2. A left shed antker (HM185). Frontal (a) and outer (b) views, × 0.4.

Explanation of Plate 3

Fig. 1. *Cervus* (*Rucervus*) *katokiyomasai* SHIKAMA & HASEGAWA Page 48–51.
A left antler with pedicle attached (HM220). Outer (a) an inner (b) views, × 0.4.


a
b