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Equid Fossils from Iwate and Miyagi Prefectures

Tokio Shikama and Yoshio Onuki

(With Plates 13-15)

In August 1960, Oikawa found some equid fossils from a road cutting at a point south of the Sakari High School, Jinomori, Ōfunato City, Iwate Prefecture ($141^{\circ}42'E.$, $39^{\circ}04'N.$). Soon after the discovery Yamada of the same school excavated the site but could find no additional remains. The fossils occurred from a gravel bed composing a terrace, 40 m. above sea level; the seven meters thick gravel beds is called the Jinomori bed by the junior writer and Mori (1961), and the terrace is known as the Jinomori terrace of Nakagawa (1961). The pebbles of the Jinomori bed are subangular or round and comprise shale, sandstone, tuff, etc. At the site of the fossils, the matrix of the gravels is soft brown sand, barren of fossils. The Pleistocene deposits of Ōfunato City are represented by the higher Marumori- and lower Jinomori terraces. Oikawa had in his possession another equid fossil derived from a fissure deposit in a limestone quarry at Sakashita, Takada City, Iwate Prefecture, 18.5 km. west to southwest of the locality of Jinomori ($141^{\circ}31'E.$, $39^{\circ}02'N.$). This quarry consists of Permian limestone and in it are some fissures filled with Pleistocene deposits mainly of brown brecciated clay. He donated these fossils to the Institute of Geology and Paleontology, Tohoku University.

In August 1960, Hirano found equid fossils from the cliff excavated to enlarge the Tajiri Middle School grounds at Ōmine, Tajiri-machi, Tōda-gun, Miyagi Prefecture ($141^{\circ}01'E.$, $38^{\circ}06'N.$). The school ground is situated on a hill, 20 m. above sea level. The level of the school ground is the lowest plane of the terrace above the alluvial plain and can be correlated to the Nakamachi terrace of Sendai City or to the Kanagasaki terrace along the middle course of the Kitakami River. The hill is composed of the Pliocene Ōnuki bed of white tuff and grey clay upon which lies a two meters thick white soft pumiceous silt with unconformity. The equid fossils occurred from the basal part of this silt bed which is the Tajiri bed. Here is should be added that the Hanaizumi peat bed south of Ichinoseki City in Iwate Prefecture is intercalated in the Kanagasaki terrace and from the bed there were found many plants and mammals such as *Leptobison hanaizumiensis* Matsumoto and Mori, *Sinomegaceroides yabei* (Shikama), *Cervus ezoensis* Heude, and *Palaeoloxodon namadicus* var. The fossils indicate the Würmian age, and are similar in their ecological condition to the Aurignacian-Magdalenian fauna from the Kuschungtung bed, Manchuria.

According to Nakagawa, the Jinomori- and Kanagasaki terraces are included in his second plane and correlated to the Tachikawa-Musashino terraces in the Kwanto Region or to the lowest terrace of South Hokkaido from which *Parelephas armeniacus* was found; this plane is the lowest terraced plane in Japan and is thought to be Würmian in age.

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Equus nipponicus Shikama and Onuki, n. sp.

Pl. 13, figs. 1-13, Pl. 14, figs. 1-14, Pl. 15, figs. 1-7.

Specimens: Isolated upper teeth of I, right C, right and left PM and M, lower I, lower left C and fragmental right and left lower rami with cheek teeth, all from Jinomori (IGPS, coll. cat. no. 77164); upper left M¹ from Sakashita (IGPS, coll. cat. no. 77165); lower jaw with cheek teeth from Tajiri in the collection of I. Hirano.

Localities: Jinomori, Ofunato City, Iwate Prefecture; Sakashita, Takada City, Iwate Prefecture; Omine, Tajiri-machi, Tôda-gun, Miyagi Prefecture.

Horizons: Jinomori bed composing Jinomori terrace; Late Pleistocene fissure deposits of a limestone quarry at Sakashita (Sakashita bed); Tajiri bed composing the lowest terrace of Latest Pleistocene: Würmian. These are correlated with the Hanaizumi bed south of Ichinoseki City, Iwate Prefecture and to the Kushungtung bed in Manchuria.

Description: The specimens from Jinomori belong to the same individual of an adult animal. The bones and teeth are yellowish white to white and sticky by tongue.

Upper incisors. Right I¹-I³ and left I¹-I³, all isolated. Crown good in preservation but dentine detached. Root broken. I¹ tubiform, gently curved backward, becoming broader distally, linguiform in cross section of distal part, with acute outer edge and a straight inner margin; lingual margin more convex than buccal; exterio-distal corners of enamel wall partly broken; grinding surface slopes from exterio-inner- to interio-outer directions. I² like I¹ in general outline but a little narrower in transverse direction and more thick in antero-posterior direction; exterior enamel edge acute and antero-distal corner of enamel wall much broken; grinding surface not so much sloped as in I¹ and triangular in cross section of proximal part. I³ flat and relatively small in size; exterior enamel edge acute and posterior enamel wall a little depressed; linguiform in cross section of distal part. Ground surface slopes outward.

	I ¹		I ²		I ³	
	R	L	R	L	R	L
Transverse diameter at ground surface	16.7	16.2	16.0+	16.0±	19.0	18.5±
Anterior-posterior diameter of the same	9.5	9.4	10.0	9.8	9.5	9.0
Height along antero-inner as preserved	38.2	41.3	40.8	38.3	32.2	19.5

Upper right canine. Tooth tubiform, small and rather poor in preservation; enamel wall detached and lingual side of crown much cracked. Tooth gently curve backward, becoming broader distally. Pulp cavity nearly quadrate in cross section. Tooth 24 mm. high at buccal side and 8.6×7.3 mm. at middle height.

Upper cheek teeth. Teeth rather well preserved, hypsodont and considerably small sized.

P². Enamel wall of buccal side much broken in right tooth, elongate trigonal in cross section, much projected anteriorly, with straight and shortest posterior margin; buccal margin crenulated, lingual margin at ground surface rather smooth and gently curved owing to coating of cement. In posterior view, tooth straight and both anterior- and posterior walls almost parallel to each other.

Protocone relatively small, oval in ground surface and does not project anteriorly. Protoloph narrow, long, runs straight and its inner- and outer margins almost parallel to each other; a small crochet-like projection occurs at anterior outer margin. Conule anterior to protoloph eminent, triangular in ground surface with an acute anterior edge.

Parastyle small but distinct with anterior margin larger than posterior which is more strongly curved than anterior one. Paracone becomes broader posteriorly and its inner margin not so much curved as that of metacone. Mesostyle eminent, broad and with weak longitudinal groove. Metacone subcrescentic with rather straight inner- and gently curved outer margins; anterior- and posterior inner corners much projected outward. Metastyle more distinct than parastyle. Hypostyle obsolete, with small crochet-like projection on its opposite side. Metaloph eminent and broad with inner- and outer margins almost parallel to each other, with a semicircular postero-inner corner. Anticrochet small but distinct. A crochet-like projection lies on an opposite side of anticrochet. Prefossette, longer than postfossette, median pulp cavity of dentine elongate oval in cross section; pre- and postfossettes not perfectly separated from each other. Crochet most distinct of enamel plications. Ground surface slopes much anteriorly and interiorly. Para-, meso- and metastyles of right P² much broken. Much cement preserved on interio-distal surface and slight on posterior surface.

	A	B	C	
P ²	{ Right	32.2	21.0+	43.5 mm.
	{ Left	32.1	21.8	45.7
P ³	{ Right	25.1	22.3+	52.0
	{ Left	26.8	23.8	57.4
P ⁴	{ Right	25.0	24.0	58.5
	{ Left	24.2	23.2	59.2
M ¹	{ Right	22.8	24.2	56.8
	{ Left	23.0	23.6	63.0
M ²	{ Right	22.5	21.8	63.8
	{ Left	23.0	21.6	68.5
M ³	{ Right	19.8	18.8	49.6
	{ Left	20.2	18.0	47.8

A: Maximum length at grinding surface. B: Maximum bucco-lingual width at ditto. C: Height along postero-inner corner as preserved.

United length of P ² -M ³ at ground surface of left teeth	144.3 mm.
Ditto of P ² -P ⁴	82.8
Ditto of M ¹ -M ³	66.4

P.³ Parastyle broken on right and left teeth with mesostyle broken on right tooth. Tooth quadrate in cross section and nearly straight in antero-posterior view.

Protocone broad and trigonal in ground surface with a nearly straight inner margin and a gently curved anterior margin. Protoloph short and broad with outer margin projected outward. Parastyle eminent, slightly projected posteriorly and with weak longitudinal depression. Paracone subcrescentic with gently curved outer- and nearly straight inner margins; posterior-inner corner projecting obtusely outward. Mesostyle eminent, with a rather straight outer margin carrying a weak median longitudinal depression.

Metacone broader and shorter than paracone with inner margin strongly projected inward. Hypostyle obsolete. Metaloph eminent, broad with an outer margin slightly curved. Anticrochet small and sharply projected. Prefossette a little longer than postfossette but almost as broad. A small cavity on the dentine of both pre- and postfossettes. Pre- and postfossettes completely separated from each other. Median area of ground surface from protocone to mesostyle depressed. Area from paracone to posterior part of protoloph

elevated, area of metacone and metaloph almost flat. Much cement preserved on inner surface and partly on other surfaces. Ground surface slopes inward.

P⁴. Tooth-like P³ in general construction but higher and shorter antero-posteriorly; in antero-posterior view, tooth slightly curved inward and in bucco-lingual view, slightly curved posteriorly. Left tooth higher than right one as preserved and postero-inner corner much worn. Protocone like that of P³ in outline but more sharply projected anteriorly. Protoloph and paracone in right tooth crescentic, elongate and narrow; outer margin of protoloph gently curved; in left tooth, broader and outer margin of protoloph not so smooth as in right tooth. Outer margin of parastyle rather straight with a weak median longitudinal depression, but that of mesostyle projected outward without longitudinal depression. Metacone like that of P³ in outline. Hypostyle moderate. Metaloph as broad as protoloph; posterior corner of metaloph more projected posteriorly in left tooth than in right. Anticrochet weaker than in P³. Dentine cavity of prefossette larger than that of P³. In buccal view, median portion of paracone and metacone highest and metastyle lowest and weakest of all. Much cement preserved on distal part of anterior-, inner- and posterior surfaces. Ground surface slopes inward.

M¹. Tooth like P⁴ in general outline, almost as high; left tooth as broad and long as P⁴, and right tooth a little smaller than P⁴. In antero-posterior view, tooth more curved inward than p⁴.

Protocone larger and longer with a more obtuse anterior edge than that of P⁴. Protoloph and paracone broader than those of P⁴ and more oblique to inner alveolar margin. Parastyle and mesostyle project obtusely without median longitudinal depression. Metacone broader and shorter than paracone; inner margin strongly projects inward as that of paracone. Hypostyle moderate. Metaloph eminent, broad with a semi-circular posterior corner. Anticrochet small while crochet, like projection of prefossette, distinct and larger than anticrochet. Prefossette larger than postfossette. Dentine cavity of prefossette smaller than that of P⁴.

Ground surface slopes inward and backward. In buccal view, median portion of paracone and metacone highest and anterior of mesostyle lowest; metastyle weakest of all. In lingual view, surface of protocone with distinct median longitudinal groove and two weak lateral longitudinal grooves.

Much cement preserved on inner surface of right tooth and moderately on distal portion of anterior- and posterior surfaces as well as on inner surface of right tooth. Four short roots preserved in left tooth; inner two confluent with each other.

M². Tooth highest of all teeth and gently curves inward and backward in lateral view. General aspect of ground surface like M¹ but a little smaller. Protocone, protoloph and paracone similar to those of M¹. Protoloph and metaloph oblique to inner alveolar margin. Paracone and metacone subcrescentic and broader than protoloph and metaloph. Hypostyle rather obsolete. Posterior corner of metaloph more strongly projected than that of M¹. Anticrochet small but distinct. In buccal view, metastyle obsolete, meso- and parastyles very distinct without longitudinal grooves. In lingual view, inner surface of protocone with a distinct median longitudinal groove and two weak lateral longitudinal grooves. Sloping of grinding surface and relief of ectoloph like those of M¹.

Much cement preserved on inner surface of right tooth, moderately on distal portion of inner surface of left tooth and partly on distal portion of anterior- and posterior surfaces. Thin enamel coating preserved on proximal portion of buccal surfaces except meso- and parastyles. Inner two roots perfectly confluent to an elongate platy root; outer two roots short and well preserved.

M³. Tooth much smaller and lower than M², subtriangular in cross section and strongly curved backward and inward. Ground surface slopes backward. Protocone

elongate oval with anterior- and posterior projections; outer margin gently crenulated. Protoloph subtrigonal, oblique to inner alveolar margin; outer margin rather straight. Anterior border of tooth gently convex anteriorly. Parastyle distinct, more strongly projected than rather obtuse mesostyle. Paracone larger than metacone and crescentic with inner margin strongly curved. Metastyle obsolete with no hypostyle on ground surface. Metaloph isolated, narrow, elongate and T-shaped; posterior corner sharp and projected. Pre- and postfossettes not separated, and postfossette open posteriorly. There is a distinct median depression on posterior border of tooth. In buccal view, parastyle distinct and highest; enamel wall between para- and mesostyle much depressed. In lingual view, inner surface of protocone with median longitudinal groove less distinct than that of M^2 . Hypostyle reaches three fourths of total height of posterior wall from root. Cement preserved considerably on all surfaces.

Lower jaw. A fragment of right ramus, preserved in anterior portion of lingual side, retains alveolar sheath of P_3 - M_2 and 122 mm. long and 50.4 mm. high as preserved. Bone flat, platy, thin and broken in upper and lower borders, the latter slightly curved outward.

A fragment of left ramus with symphysis preserved in posterior of P_4 which largely disappears by pathologic anomaly and measures 164 mm. long as preserved; tooth socket of P_4 filled with heavy bony tissue. Tip of symphysis broken and lost, I detached, although tooth sockets of right and left C preserved.

Symphysis very narrow, deep and groove-like, 39.5 mm. long as preserved, 18 mm. wide and 30.4 mm. high at posterior border. In buccal view, bone abruptly tapers forward at a portion anterior of P_2 . Exterior dental foramen suboval and measures 11.6×6.3 mm. A part of upper portion exterior of P_2 and P_3 and a part of lower portion exterior of root of P_3 are broken. Lower border of bone concave downward at a portion posterior of P_2 . Ramus thick, high and platy and inner surface rather flat although slightly depressed at its median portion. Outer surface also flat though moderately curved at its upper and lower borders. Upper crest between inner- and outer surfaces very distinct and sharp.

Lower incisors. Right I_1 - I_2 and left I_1 - I_3 isolated, with crown in good preservation except left I_3 , which outer side is much broken. Root well preserved in left I_1 , but not in others. Dentine tolerably eroded on ground surface.

I_1 tubiform, wider than long and distally suboval in cross section, but a little longer than wider and proximally trigonal in cross section. In lateral view, tooth much curved backward; outer ridge more acute than inner one; exterio-lingual surface wider than interio-lingual and gently curved, latter very flat and vertical to grinding surface. Anterior enamel surface of crown with eminent longitudinal groove. Fossette of ground surface plano-convex; anterior wall nearly straight, posterior one moderately convex backward.

I_2 wider than I_1 but similar in general construction. The outer ridge of crown projected backward. Ground surface linguiform with weakly crenulated enamel walls. Fossette opens backward with two weak longitudinal grooves on posterior enamel wall of crown; an eminent longitudinal groove runs on anterior enamel wall. Tooth not so much curved as I_1 in lateral view.

I_3 much wider than long distally, crescentic in cross section, slightly curved in lateral view, with sharp outer ridge projected outward and a flat inner enamel wall. In anterior view, a weak longitudinal groove on median portion and ground surface slopes outward; in posterior view, two accessory tubercles lie on median portions, inner one higher than outer one; a shallow, valley-like depression between posterior enamel wall much curved and with tubercles; a weak longitudinal groove extends from a sinus between tubercles on posterior enamel wall.

Lower left canine. Inner half of crown and posterior half of root broken; tooth tubiform, small and suboval in cross section with sharp anterior- and posterior edges.

	I ₁		I ₂		I ₃
	R	L	R	L	L
Transverse diameter at ground surface	14.3	15.0	—	16.2	16.5
Anterio-posterior diameter of the same	9.0	8.8	9.4	9.3	4.7
Height along antero-inner corner as preserved	44.6	55.3	—	42.0	46.8

Enamel wall smooth. Crown tip worn and dentine a little exposed. Root short and curved backward. Tooth 24 mm. high as preserved and 8.6 mm. in major diameter at middle height.

Lower cheek teeth. Teeth rather well preserved, hypsodont, platy and small sized. Enamel surface with many minute longitudinal striations.

United length of P ₂ -M ₃ at ground surface of right teeth	151.8±mm.
Ditto of P ₂ -P ₄	83.0±
Ditto of M ₁ -M ₃	71.2±

		A	B	C
P ₂	{ Right	30.3	14.8	51.2mm.
	{ Left	30.0	15.0	56.7
P ₃	{ Right	25.0	15.8	59.8
	{ Left	26.0	16.2	62.0
P ₄	Right	27.0	15.1	63.8
M ₁	{ Right	24.0	16.0	67.8
	{ Left	23.8	15.4	70.2
M ₂	{ Right	23.8	14.1	67.8
	{ Left	23.8	15.0±	71.2
M ₃	{ Right	24.4	12.7	52.0
	{ Left	23.9	12.2	53.8

A: Maximum length at grinding surface. B: Maximum bucco-lingual width at ditto. C: Height along postero-inner corner as preserved.

P₂. Tooth elongate trigonal in cross section with shortest and straight posterior margin. Grinding surface slopes outward. Buccal side consists of two major columns and lingual side of four columns.

Metallophid linguiform, broad, short and confluent, hypolophid subquadrate with rather straight inner- and gently curved outer margins. Parastyloid triangular with a sharp anterior edge pointed anteriorly; outer margin rather straight, inner margin strongly curved. Metaconid suboval, pointed anteriorly and confluent with little larger metastyloid which is subtriangular and pointed postero-interiorly. Entoconid quadrate, as wide as long and confluent with small entostyloid having straight posterior margin. In buccal view, parastyloid eminently projects upwards; median longitudinal groove very distinct.

Cement preserved on all surfaces but eroded on upper portion of lingual surface and broken off on lower portion of buccal surface. Metaconid and metallophid connected on ground surface in right tooth, but separated in left tooth. Two roots well preserved, especially in left tooth; anterior one elongate in transverse direction, posterior one elongate in antero-posterior direction; anterior root 17.2 mm. high on its posterior side and 11.5×7.5 mm. in diameter of proximal portion.

P₃. Tooth quadrate in cross section. Grinding surface slopes outward. Lingual side consists of three columns and buccal side of two columns; median longitudinal groove of lingual side larger and deeper than posterior groove.

Metalophid and hypolophid subquadrate with a rather straight outer margin; metalophid a little wider transversally and shorter antero-posteriorly than hypolophid; inner margin of metalophid moderately curved, that of hypolophid crenulated. Parastylic transverse, elongate linguiform. Entostylic distinct with straight posterior margin. Metaconid subcircular, its posterior portion projects posteriorly, confluent with metastylic, which is subtrigonal with longest and gently curved antero-inner margin. Entoconid subcircular and confluent with entostylic and hypoconid.

In lingual view, metaconid projects upward. Cement well preserved on all surfaces and eroded on uppermost portion of lingual surface, but broken on anterior-upper portion of outer surface in right tooth. Crowns of P₂ and P₃ bent backward when alveolar margin of ramus in horizontal. Two roots well preserved, suboval in cross section, its major diameter transverse.

P₄. Right tooth quadrate in cross section, a little longer and higher than P₃. Grinding surface slopes outward. In lateral view, tooth twisted posteriorly, especially on its proximal portion. Buccal side consists of two major columns and lingual side of five columns, of which two, corresponding to metaconid and metastylic, distinct, longitudinal groove between them largest and deepest.

Metalophid and hypolophid subquadrate with nearly straight outer margins; inner margin of metalophid gently curved and that of hypolophid slightly crenulated. Hypolophid longer and a little wider than metalophid. Parastylic T-shaped by a long projection directed toward metaconid; anterior margin of parastylic rather straight, enamel wall much worn interiorly. Entostylic moderate and linguiform. Metaconid and metastylic subtrigonal, anterior margin of metaconid semicircular and posterior margin rather straight; anterior and posterior margins of metastylic nearly straight, its outer margin gently curved. Entoconid subcircular and smaller than metastylic.

In lingual view, metaconid projects upward. Cement preserved on all surfaces but partly broken on buccal surface. Two roots confluent into a root of elongate oval form, its lingual margin much crenulated.

Left tooth very small, 11.3×8.9 mm. in diameter and 19.0 mm. in height; tooth set on anterior portion of tooth socket close to P₃. Anterior border flat and straight though rugose, while posterior border much concave backward, retaining a cavity-like depression. Grinding surface flat, smooth and key-shaped with straight anterior- and inner margins, and much curved posterior margin: enamel wall preserved along posterior margin seems to be anterior wall of metaconid. Proximal portion, very thin and platy, apparently not a part of root, perhaps some kind of disease.

M₁. Tooth quadrate in cross section. Grinding surface slopes inward, but smaller than P₄. In lateral view, both right and left teeth twisted backward. Buccal side consists of two and lingual side of five columns, of which three, corresponding to metaconid, metastylic and entoconid, are distinct, longitudinal groove between metaconid and metastylic largest and deepest.

Metalophid and hypolophid subquadrate with almost straight inner and outer margins except inner one of metalophid, which is convex inward. Metalophid as wide as and a little longer than hypolophid. Parastylic transverse and tapers inward; anterior margin of parastylic straight. Entostylic suboval and moderate. Metaconid also suboval, its major diameter at antero-outer to postero-inner direction. Metastylic subtrigonal, antero-inner margin straight and longest. Entoconid subquadrate, longitudinal, larger than entostylic.

In lingual view, metaconid more eminently projects upward in right than in left tooth. Cement preserved on all surfaces but partly broken on buccal surface of right tooth. Two roots well preserved, separated from one another; anterior root larger and stouter than posterior.

M₂. Tooth subquadrate in cross section, anterior margin wider than posterior. Grinding surface slopes outward and backward. Column construction in lateral view like that of M₁, but straighter than in M₁.

Metalophid and hypolophid subquadrate with nearly straight outer margins; hypolophid longer than metalophid; outer enamel wall of metalophid broken in right tooth; inner margin of metalophid much convex inward and that of hypolophid moderately crenulated. Parastylid transverse, projects inward, anterior margin straight. Entostylid moderate and subtrigonal. Metaconid of suboval shape and metastylid of subtrigonal shape extend from antero-outer to postero-inner directions; anterior margin of metastylid straight and longest. Entoconid longitudinal, subquadrate and larger than entostylid.

In lingual view, metaconid projects upward. Cement preserved on all surfaces but distal part broken on buccal surface of right tooth and on lingual surface of the left one. Two roots quite separated from each other, transverse and posterior root projects posteriorly.

M₃. Tooth elongate trigonal in cross section, narrower and a little longer than M₂. Grinding surface slopes outward and backward. In lingual view, metaconid more eminently projects upward in left tooth than in right. Buccal side consists of three columns and lingual side of four; longitudinal groove between metaconid and metastylid most distinct. Tooth gently curves backward in lateral view.

Metalophid and hypolophid linguiform with almost straight outer margins; inner margin of metalophid moderately convex inward, that of hypolophid a little crenulated; metalophid as long as and wider than hypolophid. Parastylid transverse, anterior margin almost straight. Entostylid moderate, suboval and projects backward. Metaconid sub-circular, anterior margin moderately curved. Metastylid suboval, running from antero-outer to postero-inner directions, with straight anterior and curved posterior margins. Entoconid suboval, as large as metastylid and larger than entostylid; anterior margin nearly straight, posterior slightly curved.

Cement preserved on all surfaces, but distal part partially broken on buccal surface of right tooth. Three roots confluent with one another; anterior root widest and subquadrate in cross section; median root longest and suboval in cross section, posterior root much smaller than preceding ones and suboval in cross section.

The specimens from Sakashita is yellowish white and sticky by tongue.

Upper left M₁. Tooth broken proximally, about two-thirds length preserved, quadrate in cross section, a little curved inward in antero-posterior view. In buccal view, anterior groove more distinct and deeper than posterior. General aspect of grinding surface like specimen from Jinomori, but enamel wall weaker and thinner. Protocone triangular, not so much broken. Inner wall of paracone more strongly curved than Jinomori specimen. Hypostyle obsolete and metaloph eminent. Prefossette larger than postfossette, dentine cavity of fossette very small. Grinding surface slopes inward and forward. In buccal view, metastyle highest and anterior of mesostyle lowest. In lingual view, median longitudinal groove obsolete on a surface of protocone. Much cement preserved on a distal portion of inner surface and partly on that of outer surface.

Maximum Length at grinding surface	23.0 mm.
Maximum bucco-lingual width at ditto	24.0
Height along postero-inner as preserved	65.8

The specimens from Ômine, Tajiri belong to the same individual of an aged animal;

bones and teeth yellowish grey to greyish white, but fragile and sticky by tongue.

Lower jaw. Most of left and part of right ramus preserved. Ascending ramus and a tip of symphysis broken. Lower border of left ramus cracked anteriorly and broken posteriorly; its anterior buccal surface also cracked below P₃, posterior portion of exterior dental foramen broken. Right ramus detached from symphysis at posterior of right exterior dental foramen. Left ramus 244 mm. long as preserved and 45.8mm. high at portion anterior of P₄ and 81.7 mm. high as preserved at buccal side of posterior of M₃. In buccal view, left horizontal ramus very flat and high; upper margin straight and slopes forward. In upper view, both right and left rami almost parallel to each other, jaw very long and narrow. Upper border of symphysis eroded. A part of right horizontal ramus preserved distally, retaining four teeth of P₂-M₁ in situ. M₂ and M₃ detached and not preserved. Symphysis 28.6 mm. long as preserved, 31.3 mm. high at anterior portion and 34.2 mm. wide at posterior portion. Distance between inner margins of both rami at posterior of P₄ is 34.2 mm.

Lower teeth. Teeth much worn and crown very low and small; dentine much eroded and cement tolerably detached, very fragile and rugose; enamel wall relatively thick, its surface with many minute longitudinal striations.

United length of P ₂ -M ₃ at grinding surface	148.8 mm.
Ditto of P ₂ -P ₄ at left side	78.8
Ditto of M ₁ -M ₃ at left side	70.8

		A	B	C
P ₂	{ Right	29.0	13.0	13.0±mm.
	{ Left	30.0	13.1	15.8±
P ₃	{ Right	24.7	15.9	19.2
	{ Left	24.5	14.8	12.5±
P ₄	{ Right	23.7	16.0	16.8
	{ Left	24.0	15.8	11.2+
M ₁	{ Right	19.7	15.8	19.0±
	{ Left	20.0	15.0	10.3±
M ₂	Left	21.8	14.3	10.8±
M ₃	Left	28.9	13.3	10.8±

A: Maximum length at grinding surface. B: Maximum buccolingual width at ditto. C: Height of crown along antero-outer corner.

P₂. Tooth elongate trigonal in cross section, all margins moderately crenulated, posterior one shortest. Crown bent backward and grinding surface slopes inward.

Metalophid smaller than parastyloid and metastyloid subquadrate and confluent with metastyloid, which is subtriangular with the longest and gently curved anterior margin. Parastyloid triangular and projects anteriorly, inner margin rather straight; parastyloid and metalophid in closer contact with each other than in specimens from Jinomori. Metalophid large, linguiform, well confluent with parastyloid and hypolophid, with outer margin long and moderately curved. Hypolophid quadrate, relatively wide and its inner- and outer margins nearly straight. Entostyloid obsolete, entoconid subquadrate. In lingual view, upper margin of crown nearly straight and parastyloid not projected upward as in Jinomori specimens. A small quantity of cement preserved on crown base of lingual side of right tooth and buccal side of left tooth.

P₃. Tooth subquadrate in cross section, as large as specimens from Jinomori, but

each conid and stylid larger. Crown bent backward and grinding surface slopes outward.

Metallophid suboval with short inner- and gently curved outer margins. Hypolophid subquadrate, its outer margin a little concave outward. Entostylid moderate, transverse and its posterior margin rather straight. Metaconid linguiform, expanding forward, with relatively long and straight posterior margin. Parastylid, projected inward, larger than entostylid, with acute inner edge and straight anterior margin. Metaconid linguiform, extending from antero-outer to postero-inner directions and its outer margin moderately convex outward. Entoconid suboval, much confluent with entostylid.

In lingual view, metaconid considerably projects upward and posterior portion lowest. Cement, though fragile and cracked, thickly preserved on basal portion of all surfaces, especially well on lingual surface of right tooth.

P₄. Tooth subquadrate in cross section, relatively short and wide in comparison with those from Jinomori; each conid and stylid larger than that of latter. Crown a little bent backward and grinding surface slopes outward. General outline of each conid and stylid much like those of P₃, but entoconid relatively small and metastylid relatively short. Both parastylid and entostylid extend transversally and with nearly straight anterior- and posterior margins; parastylid a little larger than entostylid.

In lingual view, metaconid sharply points upward and almost as high as metastylid and entoconid; posterior portion of metaconid lowest. Cement better preserved than in P₃.

M₁. Tooth quadrate in cross section and much shorter than specimens from Jinomori. Crown almost vertical to alveolar margin and smallest of all cheek teeth.

Metaconid relatively large, linguiform with a posterior margin concave backward, much confluent with metallophid and in close contact with transverse parastylid, and is relatively wide with a sharp inner edge. Metallophid and hypolophid subquadrate and relatively wide transversally; former a little longer than latter and outer margin of latter slightly crenulated. Entostylid not so long transversally and not so much projected as in Jinomori specimens. Entoconid subquadrate, as long as wide, relatively large, much confluent with entostylid and in close contact with metastylid. Metastylid long, linguiform, extends from antero-outer to postero-inner directions, its anterior margin concave forward.

Ground surface slopes outward. In lingual view, metaconid sharply projects upward, as high as entoconid; posterior portion of metaconid lowest. Outer surface of hypolophid with weak median longitudinal groove. Cement preserved on all surfaces, especially well on lingual surface.

M₂. Tooth quadrate in cross section, much shorter than Jinomori specimens. Crown a little bent forward and ground surface slopes outward.

Metaconid subtriangular, pointed inward, rather straight anterior- and moderately curved posterior margins, latter concave aftward. Parastylid transverse, sharply pointed inward and its anterior margin very straight. Metallophid subquadrate with a much curved inner margin. Hypolophid quadrate, longer than metallophid, nearly straight inner- and outer margins. Entostylid distinct, suboval, projected aftward and larger than those of M₁. Entoconid moderate, suboval, and much confluent with entostylid. Metastylid long, linguiform, longer than those of M₁ and its anterior margin strongly concave forward. In lingual view, metaconid highest and sharply projects upward, its posterior portion lowest; upper margin of crown rather straight from metastylid to entostylid. Cement well preserved on basal parts of all surface of crown.

M₃. Tooth elongate trigonal in cross section, much longer than specimens from Jinomori and both inner- and outer margins of grinding surface much crenulated. Crown bent forward, ground surface slopes outward.

Metaconid trigonal, a little pointed inward, posterior margin moderately concave aftward. Parastylid long, transverse, much pointed inward, and separated from metaconid.

Metalophid subquadrate with straight outer and much curved inner margins. Hypolophid also quadrate, longer than metalophid and its inner- and outer margins both nearly straight and parallel to each other. Entostylid large, subtrigonal, projected aftward and its outer margin more strongly curved than inner one. Entoconid elongate oval, extends from antero-inner to postero-outer directions. Metastylid linguiform, projected anteriorly and its anterior margin concaved forward. In lingual view, metaconid highest and much separated from metastylid; entostylid lowest and distal part of its enamel wall broken. Cement preserved on basal part of crown except on postero-inner surface. *Remarks:*—The animal of Tajiri is more aged than that of Jinomori, hence the size of each tooth and the precise shape of its ground surface are a little different from one another, but both animals seem to belong to the same species.

The noteworthy fact is that the teeth in question are far smaller than those of *E. caballus* and *E. przewalskyi*; in the latter the length of M^1 is 24.5–27.0 mm. and the united length of P_2 – M_3 is about 185.0 mm. while in the present species they are 22.8–23.0 mm. and 148.8–151.8 mm. Even *E. hemionus* seems to be a little larger than this species, and the teeth reported by Tokunaga and Naora (1939) from the Kushungtung bed under the name of *Asinus* sp. may come near to this species in size. Thus it may be said that this species is a very small sized *Equus*. Compared with the teeth of *E. caballus*, the protocone of the upper molars is projected more anteriorly, the hypostyle is not acute and the pre- and postfossettes are relatively simple in shape. Also, compared with the teeth of *E. hemionus*, the protocone and enamel plication are a little different. The writers are inclined to regard this species as a new one and the name of *E. nipponicus* Shikama and Onuki, n. sp., is proposed.

In 1938 the senior writer reported an equid tooth from an asphalt bed, the Tsukinoki bed at Tsukinoki, Toyokawa, Akita City, under the name of *E. sp. aff. hemionus*, it may safely be referred to this species. From the Tsukinoki bed were found associated this *Equus*, *Palaeoloxodon namadicus yabei* (Mat.), *Sus nipponicus* Mat., *Cervus ezoensis* Heude and *Canis* sp. It is rather an interesting fact that *Equus nipponicus* was common in the Würmian fauna of Northern Japan.

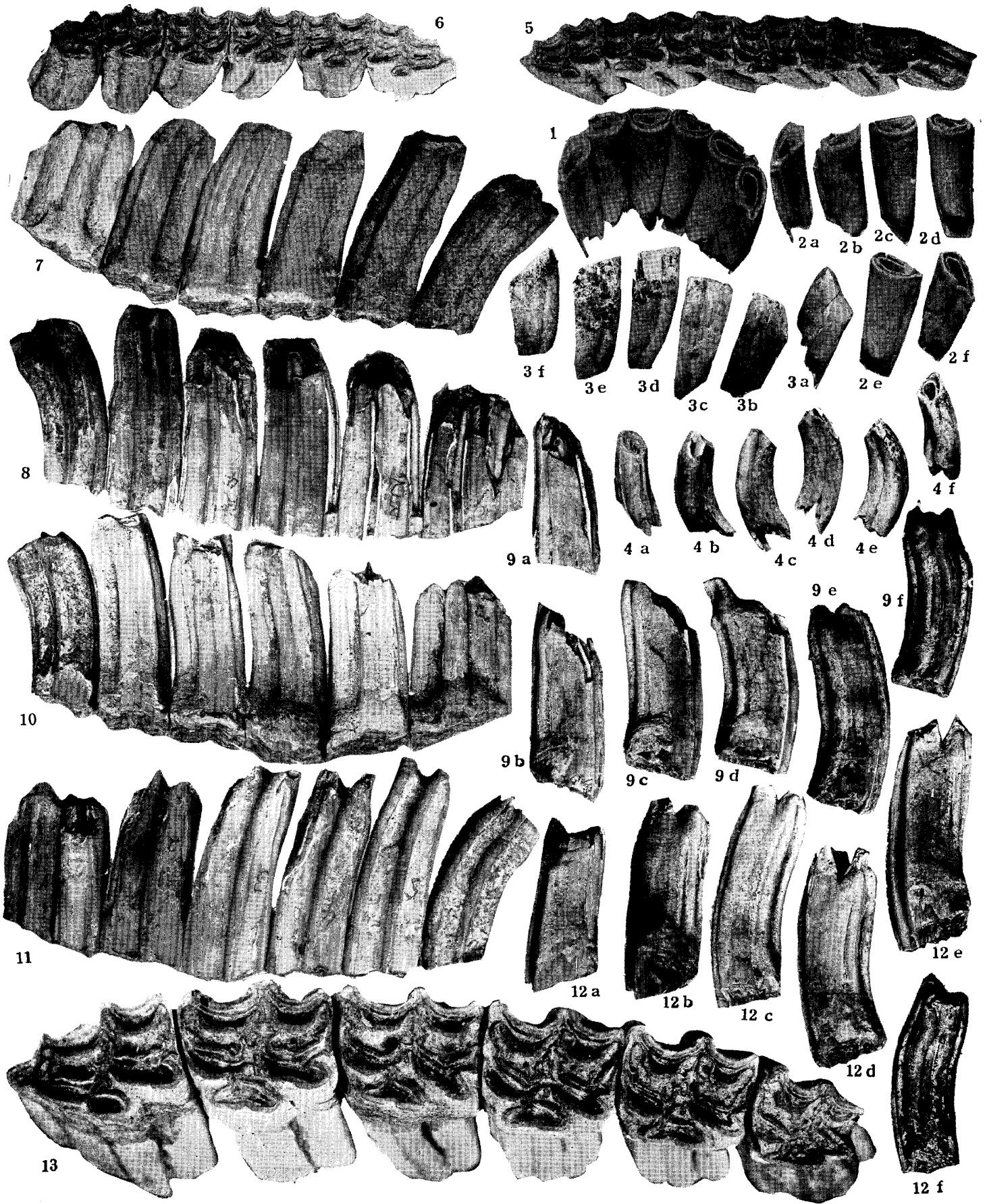
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PLATE 13

Equus nipponicus Shikama and Onuki, n. sp. ($\times 0.55$ except for fig. 13).

- Fig. 1. Lingual side of upper I, in situ.
 - Fig. 2. Ditto, isolated, a; right I³. b; right I². c; right I¹. d; left I¹. e; left I². f; left I³.
 - Fig. 3. Anterior side of ditto, isolated.
 - Fig. 4. Outer lateral side of ditto.
 - Fig. 5. Palatal side of upper left cheek teeth.
 - Fig. 6. Ditto of upper right cheek teeth.
 - Fig. 7. Lingual side of upper right cheek teeth.
 - Fig. 8. Buccal side of ditto.
 - Fig. 9. Posterior side of ditto. a; P². b; P³. c; P⁴. d; M¹. e; M². f; M³.
 - Fig. 10. Lingual side of upper left cheek teeth.
 - Fig. 11. Buccal side of ditto.
 - Fig. 12. Posterior side of ditto. a; P². b; P³. c; P⁴. d; M¹. e; M². f; M³.
 - Fig. 13. Palatal side of upper left cheek teeth, $\times 1$.
- Loc. Jinomori, Ofunato City, Iwate Prefecture. IGPS, coll. cat. no. 77164.



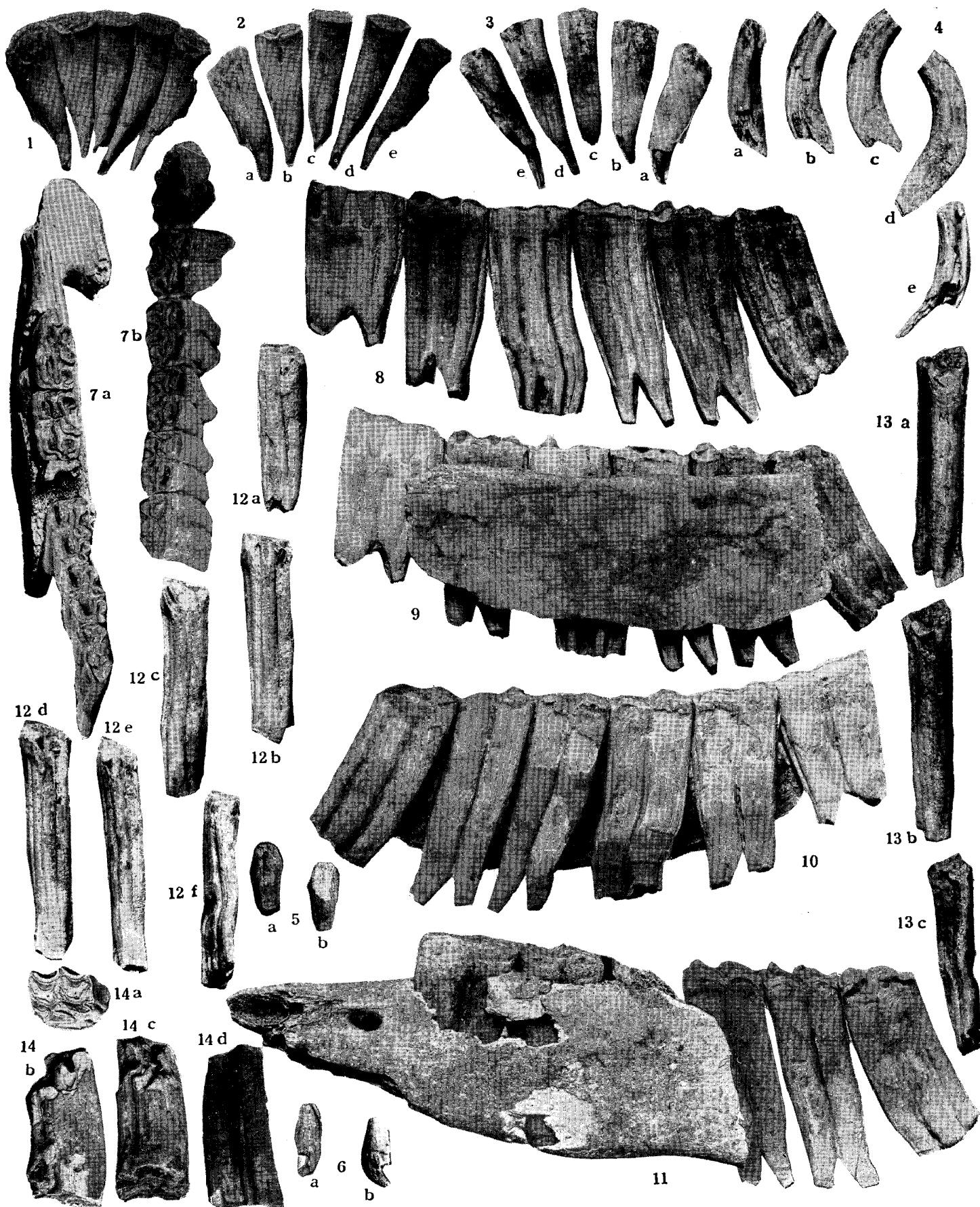


PLATE 14

Equus nipponicus Shikama and Onuki, n. sp. (× 0.55).

- Fig. 1. Lingual side of lower I, in situ.
Fig. 2. Ditto, isolated. a; left I₃. b; left I₂. c; left I₁. d; right I₁. e; right I₂.
Fig. 3. Anterior side of ditto, isolated.
Fig. 4. Outer lateral side of ditto.
Fig. 5. Upper right C. a; lingual side. b; buccal side.
Fig. 6. Lower left C.; a; lingual side. b; buccal side.
Fig. 7. a; Upper side of lower jaw and left cheek teeth.
b; Upper side of right cheek teeth.
Fig. 8. Lingual side of lower right cheek teeth from P₂ to M₃.
Fig. 9. Lingual side of a part of right ramus and cheek teeth.
Fig. 10. Buccal side of ditto.
Fig. 11. Buccal side of a part of left ramus and cheek teeth.
Fig. 12. Posterior side of lower right cheek teeth. a; P₂, b; F₃. c; P₄. d; M₁. e; M₂ f; M₃.
Fig. 13. Posterior side of lower left M₁-M₃. a; M₁ b; M₂. c; M₃.
Loc. Jinomori, Ofunato City, Iwate Prefecture. IGPS, coll. cat. no. 77164.
Fig. 14. Upper left M¹. a; palatal side. b; posterior side. c; lingual side. d; buccal side.
Loc. Sakashita, Takada City, Iwate Prefecture. IGPS, coll. cat. no. 77165.

PLATE 15

Equus nipponicus Shikama and Onuki, n. sp.

Fig. 1. Upper side of lower right cheek teeth, $\times 1$.

Fig. 2. Lingual side of a part of left ramus and cheek teeth, $\times 0.55$.

Loc. Jinomori, Ofunato City, Iwate Prefecture. IGPS, coll. cat. no. 77164.

Fig. 3. Upper side of lower jaw, $\times 0.55$

Fig. 4. Buccal side of left ramus, $\times 0.55$.

Fig. 5. Lingual side of ditto, $\times 0.55$.

Fig. 6. Lingual side of a part of right ramus, $\times 0.55$.

Fig. 7. Buccal side of ditto, $\times 0.55$.

Loc. Ōmine, Tajiri-machi, Tōda-gun, Miyagi Prefecture.

